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METRICS OF VENDOR CAPABILITIES IN OFFSHORE OUTSOURCING OF INFORMATION TECHNOLOGY FUNCTIONS: MEASUREMENT AND ANALYSIS

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Abstract

This study identifies a list of constructs from popular literature to measure offshore vendor capabilities for an outsourced IT project. A pilot study was conducted with a scenario description of an actual offshore software project. Factor analytic techniques were employed on to elicit eight constructs to measure vendor capabilities. Validity and reliability data for the measure are reported.

Keywords: Offshore outsourcing, vendor capabilities, metrics, structural equation model

Introduction

In order to maximize efficiency in Information Technology (IT) functions, corporations are increasingly considering outsourcing as a viable option (Bierce 2002). A plethora of anecdotal evidence exists to suggest that offshore outsourcing is no longer an emerging trend but a strategic imperative for many IT executives (Mayor 2000). It is critical that organizations clearly prioritize and rank their expectations and install measuring mechanisms before considering outsourcing options (Mallik, 2002). Since the possibility exists that vendors may over promise on what can be delivered for the contract price, the process of evaluating vendor capabilities must considered with great care (Kern et al. 2002).

This study attempts to create a set of metrics for vendor capabilities to be evaluated in any outsourcing venture but adapted especially to the context of offshore outsourcing of IT projects. Identification of these vendor-capability metrics will provide a focal organization with a structured approach to evaluating and ranking possible offshore vendor options. First, a list of constructs to be studied is identified. Next, a pilot study is conducted to purify and validate the instruments to measure these constructs. This article will be concluded with limitations of this study and future directions.

Theoretical Foundations

In a recent study of forty two offshore service users, Gartner report ranked a list of criteria that organizations look for in selecting an offshore vendor (Weiss 2002): maturity of offshore-service processes and methodology, cost, quality of resources, speed of delivery, project management capabilities, business process expertise, certifications, full-outsourcing capabilities, significant presence in the U.S., nultivendor capabilities, and nearshore capabilities. These criteria are constructs for which the exact values in any situation may not be measured directly. This section provides an historical account of these constructs in IS literature under the rationale that offshore outsourcing is simply transferring the expectations of these capabilities from the focal firm to an outsourcing vendor.

Maturity of Offshore Services Process and Methodology

Maturity of Information Systems has often been recognized as an important factor in evaluating not only its usefulness but also its impact on many organizational endeavors. Mahmood (1985) explored the effects of the maturity of information systems and

end-user satisfaction. Saunders and Keller (1983) studied maturity of information systems function as a factor determining the importance of information systems. Sabherwal and King (1992) have used maturity of IS function in their study of decision processes of developing strategic applications. DeLone (1981) recognized IS maturity as a factor in studying characteristics of computer use. Benbasat et al. (1980) studied the perceived usefulness of IS skill needs at different levels of organizational maturity. It is then plausible to hypothesize that IS organizations with greater maturity are likely to have personnel with greater skills. It is generally believed that outsourcing vendors have a better process maturity in their core areas as compared to the client. They also have dedicated groups specializing in particular technologies resulting in enhanced process maturity (Mallik 2002). Our use of the maturity construct here is simply transferring the consideration of *maturity* from the focal organization to an outsourcing vendor. There is also anecdotal evidence to suggest that among competing vendors, clients prefer larger vendors with financial stability and track-record (Michell and Fitzgerald 1997).

Cost

Direct cost benefits of outsourcing are often in terms of cheaper hourly rates for applications development and other IT-enabled activities. In addition, further cost savings can be realized in the form of higher productivity of employees (Mallik 2002). The need to produce software applications at a lower cost is a major driver of many outsourcing decisions. This apparent need is a natural result of many organizations experiencing cost spiraling and inability to control IS costs. Helms and Weiss (1986) studied the problems of cost controls associated with internally developed software applications. Kermer (1987) affirms that practitioners have expressed concern over their inability to accurately estimate costs associated with software development. Lederer and Prasad (1992) studied the cost estimating process of IS organizations and provide guidelines for better cost estimating of IS functions. Ang and Straub (1998) conclude that there may be production and transaction economies associated with IS outsourcing. Barthélemy (2001), while recognizing the cost savings associated with outsourcing, points out the pitfalls associated with estimating the total cost of a project. Mansfield (1988) acknowledged that innovation time and innovation costs for external technologies can be different compared to internal technologies. An extension of such recognition is exploring cost efficiencies external to the firm as evidenced by increasing trend of outsourcing across national boundaries. While market cost differential among competing vendors may become an issue, there is evidence to suggest within an acceptable range of cost other factors were important (Michell and Fitzgerald 1997).

Quality of Resources

Bessy and Weber (1983) found that programmer quality as one of the factors affecting program maintenance. Quality of computer specialists has been recognized by Mansour and Watson (1980) as a determinant of computer based information systems' performance. Perceived quality of end user application development tools has been studied by Amoroso and Cheney (1991) as a contributing factor determining end-user application effectiveness. DeLone (1981) uses percentage of sales spent on EDP expenses and percentage of EDP expenses spent on hardware in studying characteristics of computer use. Igbaria and Nachman (1990) use availability and accessibility of computer hardware as a correlate of user satisfaction with end-user computing. Outsourcing vendor can provide skills in three distinct areas: application development, technology research, and domain expertise. The quality of vendors muse evaluated in all these multiple dimensions. Drawing from these studies, we use measures of both personnel quality and infrastructure quality of outsourcing vendors.

Speed of Delivery

Timeliness of information and reports provided by the IS departments and its importance has been researched extensively (e.g., Bindiganavale and Hindupur 1990). There are a variety of reasons for delayed delivery of internally developed software projects (Helms and Weiss 1986). IT departments are often evaluated by their ability to deliver projects in time. Time savings when projects are outsourced are often the result of economies of scale as well as availability of specialized personnel who could be deployed on the project at a short notice. In an outsourcing scenario, the vendor can ramp up the develop team to adapt to a changing personnel needs of a project. Another area where the turn-around time can be reduced is by taking advantage of the time difference (say from US to India) so that the testing can be done in US working hours and the bugs fixed during Indian working hours, resulting in a 16-hour working day for projects (Mallik 2002).

Project Management Capabilities

It is generally recognized that scope management, quality management, resource management, schedule management, risk management, communications management, contract management, and financial management are all different dimensions of good project management (e.g. Randolph and Posner 1988). "…IT projects often die simply because IS departments fail to follow the basic project management principles that help ensure project success" (Field 1997) Orlikowski and Hofman (1997) highlight the need for taking advantage of the evolving capabilities, emerging practices, and unanticipated outcomes associated with the use of new technologies. Availability of project management software that includes internet based collaborative tools is major factor in the move to offshore outsourcing of IT services Frauenheim (2002). Ability to use such software and to perform a variety of standard project management tasks is especially critical in offshore outsourcing of IT projects. Another dimension of good project management practice is the ability of vendors to work with in-house personnel as project team members. In knowledge intensive areas, clients routinely play a critical role in co-producing the service solution along with the service provider. Strategically managing client co-production, service providers can improve operational efficiency, develop more optimal solutions, and generate a sustainable competitive advantage (Betterncourt et al. 2002).

Business Process Expertise

Davenport and Short (1990) believe that, "Business process design and information technology are natural partners, (and) yet industrial engineers have never fully exploited their relationship." Bohn (1994) highlights impact of organizational knowledge on performance. Talbert (2002) affirms that, "…the greatest benefits come from a tight fit between organizational processes and the enterprise application software." It is critical to transfer organizational knowledge to information systems architecture, and a clear understanding of the underlying business processes is essential to affect this transfer. This is an area where in-house development often has a clear advantage over many outsourcing vendors. In-house personnel generally have greater opportunities to understand the business processes than outsourcing vendors. But as outsourcing of IT projects become more commonplace, vendors who have experience in similar projects are likely to overcome this deficiency, and may even bring an advantage to focal firms as vendors may have developed information systems for similar processes elsewhere and bring their expertise and experience to an outsourced project. Client companies often look for vendors who can contribute to business above and beyond the service that is actually being outsourced (Michell and Fitzgerald 1997).

Certifications

Many researchers as well as practitioners have stressed the importance of education and training for software development personnel (e.g. Gordon et al. 1987). Organizational commitment to skill enhancement is an important ingredient in delivering systems of high quality (Ravichandran and Rai 2000). Organizations are less capable of evaluating the quality of personnel employed in offshore projects. There is therefore a need to rely on external organizations for ensuring the quality of software development personnel and project managers involved in offshore projects. Certifications by packaged software vendors are external organizations can attest to the quality of personnel involved in the project.

Full-outsourcing Capabilities

Outsourcing vendors often work to gain new customers and then to increase their involvement with existing customers by providing a range of support services. Customers are also increasingly seeking a relationship with an outsourcing vendor who can offer a variety of solutions that lead to a business partnership rather than outsourcing of fragmented IT projects (Rjeily and Williams 2002). They also argue that step-wise increases in value creation are achievable by moving to a full outsourcing model. The general trend in outsourcing is to outsource complete IT services (Michell and Fitzgerald 1997). Whether or not a vendor is capable of delivering extended outsourcing services if the focal firm decided to strive for additional value creation in the outsourcing partnership is an important dimension of vendor capabilities.

Significant Presence in the United States

When offshoring, companies should ensure that vendors have a significant US presence to maintain an effective channel of communication which critical to the success of all projects. It is also necessary for an onsite team to be present from the offshore

vendor after the project is awarded. But, while selecting a vendor it is essential to evaluate their potential based on their ties to US operations.

Multivendor Capabilities

It is also important that offshore vendors have the ability to deal with multiple brands of operating systems, critical software domains, and infrastructure equipments to provide flexibility to its clients. Vendors who specialize in selected brands, while may have greater expertise in a chosen technology, may constrain the options available for projects. They may also be biased in the evaluation of project components.

Nearshore Capabilities

Clients often feel comfortable in dealing with vendors who are geographically located close to the contracting firm. In addition to providing a psychological comfort, a nearer geographical location may also mean a cultural proximity and reduced transportation time and costs when the need arises.

Political Climate

There are reports that when travel advisories to the Indian subcontinent were issued recently, China used the possibility of war to divert offshore clients away from India (Basu 2002). This suggests that clients may use political climate and include factors such as political stability and threat of war in evaluating offshore vendors.

Methodology and Analysis

We first developed a set of questions for the constructs suggested in Weiss (2002). These questions were then reviewed by two experts: one familiar with outsourcing selection process in a chemical industry and the other a software analyst working for a vendor firm and familiar with issues relating to offshore outsourcing. This process resulted in elimination of seven items and inclusion of another construct – Political Climate.

To analyze the reliability and validity of this instrument, an experimental design of data collection methodology was used. A real world scenario to which the participants can relate in answering questions in the survey was created based on the literature of an outsourcing business context. This scenario was administered to 103 participants, who were mostly students enrolled in the senior and graduate level information systems program. The pilot version of the instrument was then administered. Participants included many who are currently employed in the information systems area. Table 1 gives a description of the participants. Although not all of them are the actual decision makers in outsourcing projects, it is believed that an experimental design using a real world scenario will complement this shortcoming.

Table 1. Demographic Profile of Pilot Study Participants

n = 103	Mean	Median	Range
Age	28.57 yrs old	25 yrs old	21-54
IT experience	2.45 yrs.	1.00 yr.	0 - 25 yrs.
Current employment	3.25 yrs.	2.00 yrs.	0 - 21 yrs.
Gender	Male: 74 (71.8%), Female: 28 (27.2%)		
National Origin	U.S.: 79 (76.7 %), Other: 24 (23.3%)		
Title	Database Programmer: 12 (11.7%), System Analyst: 11 (10.7%), Application Programmer: 8 (7.8%), Help Desk Stuff: 6 (5.8%), Other: 46 (44.7%)		
Internal/External Employee	Internal: 80 (77.7%), External: 4 (3.9%), Unemployed 19 (18.4%)		

Estimation of Reliability

The data were used to test the reliability and validity of the scales before verifying the measurement model using structural equation modeling. Table 2 summarizes the internal consistency measures (Cronbach's alpha). Items were dropped if the item-total correlation is low or the alpha would improve if the item is dropped. This process reduced 6 items from the list.

Then the items were factor-analyzed using principal component analysis with varimax rotation. Items were eliminated when loading more than .40 on two or more components. As a result, Cost and Quality of Resources components, while they were recognized as important components in vendor selection, were removed from further analyses of reliability because those constructs had only one item remained.

The major concern here is the discriminant validity of constructs between Project Management (PM) and Multivendor Capabilities (MV) because majority of both constructs load on one factor component. Some of the Quality of Resources and Full-outsourcing capability items also load on this component. While further investigation into this component is necessary, since this is an important aspect of this phenomenon, merging them into one component was felt as an important step in purifying the instrument. Considering the contents of items, this component was named as "Technical Capability (TC)."

Although the alpha was lowered after the purification in some of the scales, the alpha is .70 or higher in all of the cases. With these modifications, the data were again factor analyzed giving clear dimensions of these constructs. Table 3 summarizes the means, standard deviations, and scale correlations among constructs used in this analysis.

Table 2. Reliability of Measures

	Initial		After Purification	
Construct	**# of Items**	**Coefficient Alpha**	**# of Items**	**Coefficient Alpha**
Maturity of Process and Methodology (MA)	5	.89	5	.89
Cost (CO)	4	.70	dropped	-
Quality of Resources (QR)	5	.79	dropped	-
Speed of Delivery (SP)	4	.84	3	.87
Project Management (PM)	5	.85	merged	-
Business Process Expertise (BP)	4	.85	4	.85
Certification (CF)	5	.92	4	.91
Full-outsourcing Capabilities (FO)	4	.84	merged	-
Presence in the U.S. (US)	4	.86	4	.86
Multivendor Capabilities(MV)	5	.94	merged	-
Near-shore Capabilities(NS)	3	.82	2	.92
Political Climate (PC)	3	.84	2	.76
Technical Capability (TC)	-	-	9	.92

Convergent Validity

In order to test the convergent and discriminant validity of the constructs, a confirmatory factor analysis using LISREL (8.51) was conducted. Goodness of fit index (GFI) was 0.69 and non-normed fit index (NNFI) was 0.82, showing moderately poor model fit. In order to improve the model fit, we assessed the fit of internal structure. Convergent validity of instruments can be assessed by three measures: individual item reliability (squared multiple correlations for x variables), construct reliability (or composite reliability), and average variance extracted (Fornell and Larcker 1981; Bagozzi and Yi 1988; Chau 1997). Four of the items showed reliabilities lower than the .50 cutoff value, although all Lambda x's had significant t-values. These items did not pass the test of convergent validity test. Therefore, these items were deleted in a step-wise manner. After four iterations, a total of four items were deleted. Table 4 shows the summary of the model fit measures in the new confirmatory factor analysis.

Table 3. Correlation Matrix for Scales (aggregated scale for each of the measures)

	Mean	Std. Deviation	MA	SP	TC	BP	CF	US	NS	PC
MA	5.56	1.06	1							
SP	5.66	0.88	0.126	1						
TC	5.90	0.92	**0.422****	**0.417****	1					
BP	5.41	1.01	**0.295****	**0.351****	**0.477****	1				
CF	5.17	0.99	0.125	**0.466****	**0.414****	**0.584****	1			
US	5.20	1.02	**0.344****	**0.404****	**0.573****	**0.435****	**0.488****	1		
NS	4.59	1.41	**0.215***	**0.268****	**0.342****	**0.371****	**0.331****	**0.500****	1	
PC	5.91	1.07	**0.272****	**0.421****	**0.387****	**0.289****	**0.309****	**0.492****	**0.377****	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 4. Fit Indices for the Model

χ^2	556.37 (df=349, p<.01)
χ^2/df	1.59
GFI	0.73
NNFI	0.85
RMSEA	0.076

Table 5 provides the construct reliability (*[squared sum of loadings] / [(squared sum of loadings) + (sum of error variances)]*), and Table 6 shows the average variance extracted (*[sum of squared loadings] / [(sum of squared loadings) + (sum of error variances)]*) (Chau 1997). All constructs but one now showed high construct reliabilities and high levels of average variance extracted. Political Climate construct demonstrated reliability of slightly less than .80 here. It is understandable as the construct now has only two items.

Table 5. Construct Reliability

	Construct Reliability
MA	0.89
SP	0.87
TC	0.94
BP	0.86
CF	0.92
US	0.86
NS	0.92
PC	0.77

Table 6. Average Variance Extracted

	Average Variance Extracted
MA	0.63
SP	0.69
TC	0.72
BP	0.60
CF	0.74
US	0.68
NS	0.86
PC	0.63

Discriminant Validity

Discriminant validity can be assessed by comparing the squared correlation between two constructs with their respective average variance extracted. Discriminant validity is demonstrated if the squared correlation is smaller than both of the average variance extracted. Table 7 shows the results of this test. All pairs of constructs demonstrated the discriminant validity.

Table 7. Squared Correlation

	Average Variance Extracted	MA	SP	TC	BP	CF	US	NS	PC
MA	0.63	1	0.016	0.178	0.087	0.016	0.118	0.046	0.074
SP	0.69	0.016	1	0.174	0.123	0.218	0.163	0.072	0.177
TC	0.72	0.178	0.174	1	0.228	0.171	0.329	0.117	0.150
BP	0.60	0.087	0.123	0.228	1	0.341	0.189	0.138	0.084
CF	0.74	0.016	0.218	0.171	0.341	1	0.238	0.110	0.095
US	0.68	0.118	0.163	0.329	0.189	0.238	1	0.250	0.242
NS	0.86	0.046	0.072	0.117	0.138	0.110	0.250	1	0.142
PC	0.63	0.074	0.177	0.150	0.084	0.095	0.242	0.142	1

Conclusion

This study had some limitations to generalize the findings. First, the sample was not exactly the representatives of the decision makers in outsourcing projects, even though it was covered by the experimental design using a real world scenario. Second limitation is that only one scenario was used. The responses might be different in a different situation. Thirdly, the number of observation was smaller than conventional requirement for statistical analysis. The results may be statistically weak. None the less for that, this could be a start point for further validation of the instruments.

The final version of the instrument with eight constructs (reproduced in the appendix) showed moderate to fairly good convergent and divergent validity as well as reliability. Note that these eight constructs do not include cost and quality of resources, which were recognized as important aspects of vendor capabilities but dropped from reliability analyses because they did not have more than one item. This instrument with a cost and quality of resources can be used in research to measure vendor capabilities. Possible areas of use of this measure include research exploring the relationship of vendor capabilities to the performance and satisfaction of an outsourced project. Another area for study is to explore whether the expected vender capabilities vary with project types.

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Appendix. The Instrument of Vendor Capabilities in Offshore Outsourcing

It is important to me that the off shore vendor ….

Maturity of offshore services process and methodology

1. has been in business for a long time
2. is an established offshore outsourcing vendor
3. is well-known among offshore outsourcing vendors
4. is using well-known system development practices
5. has proven system development processes

Speed of Delivery

1. is able to put together a software development team at a quick notice
2. is able to deliver the project quickly
3. is able to speed up the project delivery if necessary

Business Process Expertise

1. has worked with similar applications before
2. has outsourced projects for organizations similar to ours
3. as personnel who have prior knowledge of our business processes
4. has personnel who have prior knowledge of our industry

Certifications

1. has project management personnel who are recognized by accrediting agencies
2. has line level personnel who have appropriate certifications
3. has a culture for making its members for enrolling certification courses
4. has a policy for requiring its personnel to get certified

Significant presence in US

1. is working with many companies located in US
2. has project personnel who can be located in US, if necessary
3. as interacted with many US companies

Technical Capabilities

Project Management Capabilities

1. has project managers with proven experience

MultiVendor Capabilities

1. is able to work with different operating systems
2. is able to work with different networking technologies
3. is able to understand with both mainframes and PC oriented architectures
4. is able to work with different brands of hardware

Full)utsourcing Capability

1. is able to support multiple dimensions such infrastructure, systems development and help desk outsourcing

Near Shore Capabilities

1. is not located in a country that is far off
2. is located in a country that is close to US

Political Climate

1. is located in a country that is has friendly relationship with US
2. is located in a country where the threat of war is low

Cost

1. has a substantial labor pool that will keep the costs to the minimum

Quality of Resources

1. has well-qualified programmers