International Journal of Production Management and Engineering

http://dx.doi.org/10.4995/ijpme.2014.2096
Received 2014-01-21 - Accepted 2014-06-12

ISM Approach to Model Offshore Outsourcing Risks

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Abstract: In an effort to achieve a competitive advantage via cost reductions and improved market responsiveness, organizations are increasingly employing offshore outsourcing as a major component of their supply chain strategies. But as evident from literature number of risks such as Political risk, Risk due to cultural differences, Compliance and regulatory risk, Opportunistic risk and Organization structural risk, which adversely affect the performance of offshore outsourcing in a supply chain network. This also leads to dissatisfaction among different stake holders. The main objective of this paper is to identify and understand the mutual interaction among various risks which affect the performance of offshore outsourcing. To this effect, authors have identified various risks through extant review of literature. From this information, an integrated model using interpretive structural modelling (ISM) for risks affecting offshore outsourcing is developed and the structural relationships between these risks are modeled. Further, MICMAC analysis is done to analyze the driving power and dependency of risks which shall be helpful to managers to identify and classify important criterions and to reveal the direct and indirect effects of each criterion on offshore outsourcing. Results show that political risk and risk due to cultural differences act as strong drivers.

Key words: offshore outsourcing, service, risk, interpretive structural modelling, supply chain.

1. Introduction

In an effort to achieve a competitive advantage via cost reductions and improved market responsiveness, organizations are increasingly employing outsourcing as a major component of their supply chain strategies (Lockamy & McCormack, 2010). Outsourcing refers to the practice of a firm entrusting to an external entity the performance of an activity that was earlier performed in-house. The outsourced activity could either be the manufacturing of a good or the performance of a service, Outsourcing to third party firms based in other countries is commonly referred to as offshore outsourcing (Varadarajan, 2009). Offshore-outsourcing entails that the service being conducted by sub-contractors in other countries, who are not employees of the organization (Honeycutt *et al.*, 2012). This phenomenon has gained increased importance and attention in both theory as well as practice and has been coined ''the next wave of Globalization'' (Dossani and Kenney, 2007). In actual terms, offshore outsourcing is more risky than domestic outsourcing, given the lack of vendor's information, managerial difficulties, political or economical uncertainty, and the cost of knowledge transfer in a culturally different environment, and further adding the costs of stolen intellectual property, the challenge become greater (Jiang *et al.*, 2007). Offshoring is, after all, an inherently risky business due to the complexity of achieving ''suitable management oversight'' and control from a distance (Wright, 2005). Due to increasing globalization and technological discontinuities, firms strive to develop new product capabilities and flexibilities by engaging in outsourcing activities and adopting modular systems. However, these strategies contain risks of opportunistic expropriation of tacit knowledge and costs related to monitoring sourcing partners who are geographically and culturally distant (Harmancioglu, 2009). According to Fel & Griette, (2012) many risks present in offshoring outsourcing including natural and political risks of disruptive events, as well as intellectual-property risk and Environment, including government support, business environment, local culture and accessibility.

During the last decade, enormous research has been done in the offshore outsourcing specifically for risk mitigation e.g. Aron *et al.* (2005) and Ellram *et al.* (2008) in their papers, utilized the framework of transaction cost economics to develop an understanding of how firms manage the costs and risks of offshore outsourcing of professional services. Hertah & Kishore, (2009) discussed the applicability and potential of balanced score card method to effectively implement an outsourcing strategy and reduce the risks. Stringfellow *et al.* (2008) combined existing service operations theory with insights from the literature on communications and culture to present a new conceptual framework to find out cost drivers related to risk due to cultural differences. Youngdahl & Ramaswamy, (2008) presented two complementary conceptual models that help to shed light on the complexities of offshoring service and knowledge work related to operational risk. Jensen, (2012) used activity-based approach to the study of the offshore outsourcing of high-value, advanced services and presented the theoretical framework to integrate resource-based view for analyzing the risks. Youngdahl *et al.*, (2010) developed conceptual model that links economic development, national cultural predispositions, and the future of offshoring service and knowledge functions. Tjader *et al.*, (2013) combined the analytic network process and the balanced score card approach to build a cohesive decision model for determining firm level IT outsourcing strategy and further examined the robustness of the model through sensitivity analysis. Chou & Chou, (2009) identified an information systems outsourcing life cycle through three project related periods: pre-contract phase, contract phase, and post-contract phase. Also, various risk factors associated with each phase of the information system outsourcing practice have been identified and examined. Mathew & Chen, (2013) focused on three major modes of relational norms: norm of flexibility, norm of solidarity and norm of information exchange for achieving offshore software development success, thus mitigating the risks involved. Stratman, (2008) used transaction cost theory and operations management models of service process to identify challenges to the effective offshoring of service processes. Doh, (2005) suggested that international labour and environmental standards and corporate codes of conduct could mitigate some of the most intense concerns raised about offshoring but conclude that offshoring is likely to present challenges to societies, corporations, and stakeholders for many decades. Cai *et al.*, (2011) presented a theoretic method to control outsourcing risks by designing the incentive and monitoring mechanism of the producer services outsourcing contract. Hahn & Bunyaratavej, (2010) empirically examined theoretical development of service cultural alignment and investigated the impact of cultural dimensions on the location of service offshoring projects.

As evident from above literature studies, number of approaches, models, empirical as well as conceptual has been developed by researchers to study or model the impact of various risks on offshore outsourcing. But very limited research, which examines the relationship between various types offshoring risks is found (Aron *et al.*, 2005; Wright, 2005; Goo & Huang, 2008; Harmancioglu, 2009; Chou & Chou, 2009, 2011; Youngdahl *et al.*, 2010; Datta & Roy, 2012). Owing to the complex nature of offshore outsourcing because of its interface between cultures, organizations, disciplines, technologies and tacit knowledge of employees, it is very difficult to analyze the inter-relationship among the various risks.

In literature, various methods such as AHP, ISM and ANP are used by authors to examine the inter-relationships (see, e.g., Shang *et al.*, 2004; Wei *et al.*, 2005; Raj *et al.*, 2008; Subramanian & Ramanathan, 2012).

Authors, in the present study make use of interpretive structural modelling (ISM), a well established methodology for identifying relationships among specific items, which defines risk.

The main objectives of this paper are:

1. To identify risks involved in offshore outsourcing of professional services
2. To establish the relationship between these identified risks using interpretive structural modeling
3. To propose a structural model for risks of offshore outsourcing
4. To classify the identified risks into various categories using MICMAC analysis

The remainder of this paper is organized as follows. After Introduction in section 1, section 2 presents ISM methodology. Section 3 presents the literature review with respect to nine types of potential risks. Section 4 presents the details of ISM approach to model offshore outsourcing risks Section 5 presents the discussions. Conclusion and further research directions are presented in section 6.

2. An overview of ISM approach

Interpretive structural modelling (ISM) is an interactive learning process whereby a set of different indirectly and directly related elements are structured into a comprehensive systemic model. The presence of indirectly or directly related elements complicates the structure of the system which may or may not be articulated in a clear fashion. It becomes difficult to deal with such a system where structure is not clearly defined. Hence, a methodology needs to be developed which aids in the identification of a structure within a system, interpretive structural modelling is such a methodology. Several examples of the use of ISM have appeared in the literature. There are two basic concepts which are essential to understand the ISM methodology. One is the concept of reachability and the other is that of transitivity.

Common terminology used to represent relationship between elements is discussed as under:

Four symbols used to denote the direction of relationship between the elements are given below (i and j)

V: → element i will reaches element j

A: → element j will reaches element i

X: → elements i and j will help to alleviate each other

O: → elements i and j will not related to each other

This information is represented in the form of binary matrix and it is called initial reachability matrix. If an element i reaches element j, then the entry in the cell (i, j) of the reachability matrix is 1 and if element i does not reach element j, then entry in the cell (i, j) of the reachability matrix is 0.

If element i reaches to element j and element j reaches to element k, then transitivity implies element i reaches to element k.

The steps involved in ISM approach are shown in Figure 1.

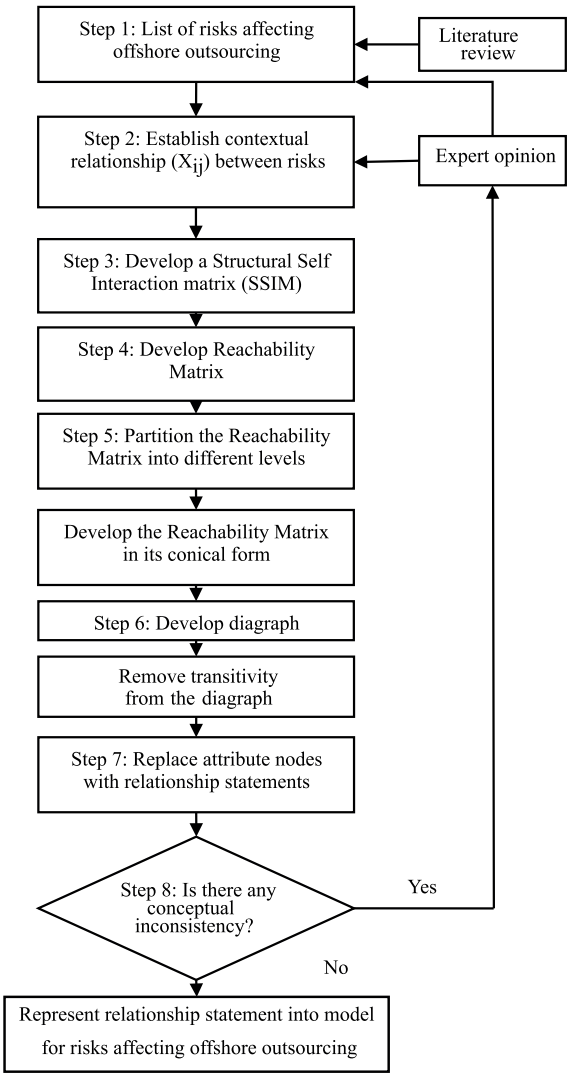

Figure 1. Flow diagram for ISM approach.

3. Identification of risks related to offshore Outsourcing

Recent concerns over the intellectual property protection in software production are an early indication of what could be a growing phenomenon (Doh, 2005). As with all outsourcing contracts, the threat of Intellectual Property (IP) infringement is very serious and needs to be taken into account prior to signing a contract (Currie *et al.*, 2008). Rao (2004) explored issues about doing business overseas, and discussed factors from the availability of telecommunications infrastructure to cultural differences and language barriers, as well as legal and regulatory challenges of conducting business elsewhere. Regulatory uncertainty in developing countries is generally considered a risk that raises transaction costs (Stratman, 2008). Hahn & Bunyaratavej, 2010 considered the possibility that firms may be averse to countries that have higher levels of political risk as firms may prefer to do business in more stable environments. Outsourcing may be subject to political risk both from home country protectionist pressures and the traditional risk of operating in a foreign country (Sambharya & Rasheed, 2012).

When the service process is non-standardized, requires complex judgment and has reciprocal interdependence among steps and sequences, the reliability and assurance of service quality are at risk (Stringfellow *et al.*, 2008). It happens with knowledge process work or R & D related work of outsourcing. Mitigation of operational risk is very critical in the process because the cost of failure can be high (Youngdahl & Ramaswamy, 2008). Language, cultural and time zone differences are obvious problems that complicate offshore process management (Stratman, 2008). When outsourcing is carried out with an offshore vendor it poses additional risks such as cultural differences, language barriers, and geographical and time zone related barriers (Hertah & Kishore, 2009). Risks that result from opportunistic behavior of one or both parties i.e buyer and supplier (Aron *et al.*, 2005). This opportunistic behavior may result in failure of cooperative innovation and it includes shirking, cheating, and distorting information (Li *et al.*, 2008). A strong commitment to and identification with the project at all levels of the organization, involving forbearance and avoidance of opportunistic behavior would be essential (Søderberg *et al.*, 2013).

Some structural risk arises because vendors can stop investing in training or employ people who aren't as qualified as the agents they presented during negotiations (Aron & Singh, 2005). Yet another risk is the supplier making changes to processes, technologies, and procedures without properly informing the buying firm (Ellram *et al*., 2008). The mid-contract sag occurs after the supplier has dispensed all their transformational levers (consolidation, standardization, reduced headcount, better technology, and better processes) (Lacity *et al.*, 2008). Few cost related risks, such as unexpected transition and management costs, switching costs, costly contractual amendments, disputes and litigation (Chou & Chou, 2009). There is a potential risk of incurring transition costs, and project and vendor management costs, which can more than offset the savings from outsourcing, resulting in a net loss (Tjader, *et al*., 2013). According to Carmel & Agarwal (2002), the use of offshore resources creates uncertainty and turmoil among internal staff.The loss of critical knowledge is seen as the greatest source of workforce-related risk around outsourcing (Pfannenstein & Tsai, 2004). After the first few years of a large outsourcing contract, the client's knowledge retention can dramatically erode through attrition (Lacity *et al.*, 2008).

Based upon the extant review of literature, authors grouped them under nine categories presented in Table 1.

4. ISM approach to modelling

The various steps involved in ISM technique used to model the structural relationship among identified risks are discussed in the following paragraphs:

4.1. Establishing the contextual relationship among variables (risks)

After identifying and enlisting the 9 risks, the next step is to analyze the risks. For this purpose, a contextual relationship of 'reaches to' type is selected. This means that one risk reaches to another risk. Based on this principle, a contextual relationship is developed.

Some experts, from various organizations related to outsourcing were consulted to assist in developing the contextual relationships between the risks. Keeping in mind the contextual relationship for each risk, the existence of a relation between any two risks (i and j) and the associated direction of this relation is decided. To analyze the risk for the development of the structural self-interaction matrix (SSIM), the following four symbols are used to denote the direction of the relationship between the risks (i and j).

1. V is used for the relation from risk i to risk j (i.e. if risk i reaches risk j).
2. A is used for the relation from risk j to risk i (i.e. if risk j reaches risk i).
3. X is used for both direction relations (i.e. if risks I and j influence each other).
4. O is used for no relation between two risks (i.e. if risks i and j are unrelated).

4.2. Development of a structural self interaction matrix (SSIM)

Based on the contextual relationship between the risks, the SSIM was developed. To achieve consensus, the SSIM was discussed in a group of experts. Based on their responses, the SSIM was finalized and is presented in Table. 2.

Table 1. Identification of Risks related to offshore outsourcing.

S. No.	Name of Risk	Definition	References
1	Intellectual Property risk	Intellectual property (IP) risk is where the vendors or their staff will misappropriate IP even where the contract stipulates that IP rights solely belong to the client.	(Fleming & Sorenson, 2001), (Doh, 2005), (Frank, 2005), (Jiang *et al.*, 2007), (Li *et al.*, 2008), (Currie *et al.*, 2008), (Lacity *et al.*, 2008), (Raiborn *et al.*, 2009), (Tjader *et al.*, 2010), (Chou & Chou, 2011), (Fel & Griette, 2012), (Nassimbeni *et al*., 2012), (Mathew & Chen, 2013)
2	Compliance and regulatory risk	Compliance and regulatory risk is where an outsourcing contract inhibits the client from complying with a compliance or regulatory framework.	(Rao, 2004), (Graham, 2004), (Currie *et al.*, 2008), (Stratman, 2008), (Aron *et al.*, 2008), (Forte, 2009), (Luo *et al.*, 2010), (Chou & Chou, 2011), (Benlian & Hess, 2011), (Bachlechner *et al.*, 2013)
3	Political risk	These are risks associated with different regions with their different socio-political systems and different historical contexts.	(Prasad & Babbar, 2000), (Aron *et al.*, 2005), (Wright, 2005), (Jiang *et al.*, 2007), (Ellram *et al.*, 2008), (Stratman, 2008), (Currie *et al.*, 2008), (Nakatsu & Iacovou, 2009), (Tjader *et al.*, 2010), (Hahn & Bunyaratavej, 2010), (Cappelli, 2011), (Fel & Griette, 2012), (Sambharya & Rasheed, 2012)
4	Operational risk	Operational risk is where services will not be delivered as expected or that there will be failure in infrastructure or technology that will impede continuity of service to customers.	(Quélin & Duhamel, 2003), , (Aron & Singh, 2005), (Aron *et al.*, 2005), (Currie *et al.*, 2008), (Aron *et al.*, 2008), (Youngdahl & Ramaswamy, 2008), (Ellram *et al.* 2008), (Goo & Huang, 2008) (Stringfellow *et al.*, 2008), (Chou & Chou, 2009), (Hertah & Kishore, 2009), (Raiborn *et al.*, 2009), (Krishnamurthy *et al.*, 2009), (Bachlechner *et al.*, 2013)
5	Risk due to cultural differences	Cultural differences relate to deep-seated values and are also often more difficult to observe than language differences, so they may go unnoticed.	(Prasad & Babbar, 2000), (Rao, 2004), (Ellram *et al.* 2008), (Stringfellow *et al.*, 2008),(Youngdahl & Ramaswamy, 2008), (Stratman, 2008), (Nakatsu & Iacovou, 2009), (Hertah & Kishore, 2009), (Tjader *et al.*, 2010), (Youngdahl *et al.*, 2010), (Honeycutt *et al.*, 2012), (Fel & Griette, 2012)
6	Opportunistic risk	Opportunistic risk is related with behavior of service provider which may result in failure of cooperative innovation and it includes shirking, cheating, and distorting information.	(Aron *et al.*, 2005), (Li *et al.*, 2008), (Stratman, 2008), (Aron *et al.*, 2008), (Goo & Huang, 2008), (Mao *et al.*, 2008), (Chou & Chou, 2009), (Harmancioglu, 2009), (Raiborn *et al.*, 2009), (Tjader *et al.*, 2010), (Lacity, *et al.*, 2011), (Cai *et al.*, 2011), (Datta & Roy, 2012), (Nassimbeni *et al*., 2012), (Mathew & Chen, 2013), (Søderberg *et al.*, 2013)
7	Organization structural risk	The offshore service provider can stop investing in training or employ people who aren't as qualified as the agents they presented during negotiations.	(Henderson & Clark, 1900), (Quélin & Duhamel, 2003), (Aron & Singh, 2005), (Ellram *et al.* 2008), (Shekhar, 2008), (Lacity *et al.*, 2008)
8	Financial risk	Risks, such as unexpected transition and management costs, switching costs, costly contractual amendments, disputes and litigation.	(Overby, 2003), (Pfannenstein & Tsai, 2004), (Ellram *et al.* 2008), (Lacity *et al.*, 2008), (Chou & Chou, 2009), (Hertah & Kishore, 2009), (Fel & Griette, 2012), (Sambharya & Rasheed, 2012), (Tjader, *et al.*, 2013)
9	Loss of core professionals	The loss of critical knowledge is seen as the greatest source of workforce-related offshore outsourcing risk.	(Carmel & Agarwal, 2002), (Quélin & Duhamel, 2003), (Pfannenstein & Tsai, 2004), (Aron *et al.*, 2005), (Ellram *et al.* 2008), (Lacity *et al.*, 2008), (Chou & Chou, 2009), (Hertah & Kishore, 2009), (Jensen, 2012), (Tayauova, 2012)

Table 2. SSIM (Structural Self Interaction matrix).

S. No.	Variables(Risks)	2	3	4	5	6	7	8	9
1	Intellectual property risk	O	O	X	O	A	O	X	X
2	Compliance and regulatory risk		A	V	A	X	X	V	O
3	Political risk			V	V	O	O	V	O
4	Operational risk				A	A	A	V	O
5	Risk due to cultural differences					O	V	V	O
6	Opportunistic risk						V	V	O
7	Organisation structural risk							V	O
8	Financial risk								O
9	Loss of core professionals								

4.3. Development of the initial reachability matrix (IRM)

The SSIM was converted into a binary matrix, called the initial reachability matrix by substituting V, A, X and O with 1 and 0 as per the case and is presented in Table 3. The substitution of 1s and 0s are as per the following rules:

1. If the (i, j) entry in the SSIM is V, the (i, j) entry in the initial reachability matrix becomes 1 and the (j, i) entry becomes 0.
2. If the (i, j) entry in the SSIM is A, the (i, j) entry in the initial reachability matrix becomes 0 and the (j, i) entry becomes 1.
3. If the (i, j) entry in the SSIM is X, the (i, j) entry in the initial reachability matrix becomes 1 and the (j, i) entry also becomes 1.
4. If the (i, j) entry in the SSIM is O, the (i, j) entry in the initial reachability matrix becomes 0 and the (j, i) entry also becomes 0.

Table 3. IRM (Initial reachability matrix).

S. No.	Variables(Risks)	1	2	3	4	5	6	7	8	9
1	Intellectual property risk	1	0	0	1	0	0	0	1	1
2	Compliance and regulatory risk	0	1	0	1	0	1	1	1	0
3	Political risk	0	1	1	1	1	0	0	1	0
4	Operational risk	1	0	0	1	0	0	0	1	0
5	Risk due to cultural differences	0	1	0	1	1	0	1	1	0
6	Opportunistic risk	1	1	0	1	0	1	1	1	0
7	Organization Structural risk	0	1	0	1	0	0	1	1	0
8	Financial risk	1	0	0	0	0	0	0	1	0
9	Loss of core professionals	1	0	0	0	0	0	0	0	1

4.4. Development of the final reachability matrix (FRM)

The initial reachability matrix was converted into a final reachability matrix (FRM) and is presented in Table 4. It considers transitivity concept of ISM methodology. Table 5. shows final reachability matrix with driving power and dependence.

Table 4. FRM (Final reachability matrix).

S. No.	Variables(Risks)	1	2	3	4	5	6	7	8	9
1	Intellectual property risk	1	0	0	1	0	0	0	1	1
2	Compliance and regulatory risk	1	1	0	1	0	1	1	1	1
3	Political risk	1	1	1	1	1	1	1	1	1
4	Operational risk	1	0	0	1	0	0	0	1	1
5	Risk due to cultural differences	1	1	0	1	1	1	1	1	1
6	Opportunistic risk	1	1	0	1	0	1	1	1	1
7	Organization Structural risk	1	1	0	1	0	1	1	1	1
8	Financial risk	1	0	0	1	0	0	0	1	1
9	Loss of core professionals	1	0	0	1	0	0	0	1	1

Table 5. FRM (Final reachability matrix with driving Power and dependence).

S. No.	Variables(Risks)	1	2	3	4	5	6	7	8	9	Driving Power
1	Intellectual property risk	1	0	0	1	0	0	0	1	1	4
2	Compliance and regulatory risk	1	1	0	1	0	1	1	1	1	7
3	Political risk	1	1	1	1	1	1	1	1	1	9
4	Operational risk	1	0	0	1	0	0	0	1	1	4
5	Risk due to cultural differences	1	1	0	1	1	1	1	1	1	8
6	Opportunistic risk	1	1	0	1	0	1	1	1	1	7
7	Organization Structural risk	1	1	0	1	0	1	1	1	1	7
8	Financial risk	1	0	0	1	0	0	0	1	1	4
9	Loss of core professionals	1	0	0	1	0	0	0	1	1	4
	Dependence	9	5	1	9	2	5	5	9	9	

4.5. Partitioning the final reachability Matrix

Once the reachability matrix has been created, it must be processed to extract the structural model. The reachability set consists of the risk (i) itself and the other risks which are reachable from that particular risk (i). For every column which contains 1 in the row of the considered risk (i), the risk that column represents is included in the reachability set.

Similarly, the antecedent set consists of the risk (i) itself and the other risks which may reach the risk (i). For every row which contains 1 in the column of considered risk (i), the risk that row represents is included in the antecedent set. After finding the reachability and antecedent sets for each risk, the intersection of these sets is derived for all the risks and levels. The variables for which the reachability and the intersection are the same are given the top level in the ISM hierarchy. This procedure is continued till all levels of the structure are identified. These identified levels help in the development of the model. In the present case the level identification process for the 9 risks was completed in four iterations and is shown in Tables 6 -9. Further in Table 10, ISM based levels of variables or risks are shown.

Table 6. First Iteration.

Variables	Reachability	Antecedent	Intersection	Level
1	1,4,8,9	1,2,3,4,5,7, 8,9	1,4,8,9	I
2	1,2,4,6,7,8,9	2,3,5,6,7	2,6,7	
3	1,2,3,4,5,6, 7,8,9	3	3	
4	1,4,8,9	1,2,3,4,5,6,7, 8,9	1,4,8,9	I
5	1,4,5,6,7,8,9	3,5,	5	
6	1,2,4,6,7,8,9	2,3,5,6,7	2,6,7	
7	1,2,4,6,7,8,9	2,3,5,6,7	2,6,7	
8	1,4,8,9	1,2,3,4,5,6,7, 8,9	1,4,8,9	I
9	1,4,8,9	1,2,3,4,5,6,7, 8,9	1,4,8,9	I

Table 7. Second Iteration.

Variables	Reachability	Antecedent	Intersection	Level
2	2,6,7	2,3,5,6,7	2,6,7	II
3	2,3,5,6,7	3	3	
5	2,5,6,7	3,5	5	
6	2,6,7	2,3,5,6,7	2,6,7	II
7	2,6,7	2,3,5,6,7	2,6,7	II

Table 8. Third Iteration.

Variables	Reachability	Antecedent	Intersection	Level
3	3,5	3	3	
5	5	3,5	5	III

Table 9. Fourth Iteration.

Variable	Reachability	Antecedent	Intersection	Level
3	3	3	3	IV

Table 10. ISM based levels of variables.

S. No.	Variables(Risks)	Levels
1	Intellectual property risk	I
2	Compliance and regulatory risk	II
3	Political risk	IV
4	Operational risk	I
5	Risk due to cultural differences	III
6	Opportunistic risk	II
7	Organization Structural risk	II
8	Financial risk	I
9	Loss of core professionals	I

4.6. Development of conical matrix

A conical matrix is developed by clubbing together risks in the same level, across the rows and columns of the final reachability matrix is presented in Table 11. The driving power of a risk is derived by adding the number of ones in the rows, and the dependency is derived by adding up numbers ones in the columns.

Table 11. Conical Matrix.

Risks (number of risk)	1	4	8	9	2	6	7	5	3	Driving power
Intellectual property risk (1)	1	1	1	1	0	0	0	0	0	4
Operational risk (4)	1	1	1	1	0	0	0	0	0	4
Financial risk (8)	1	1	1	1	0	0	0	0	0	4
Loss of core professionals (9)	1	1	1	1	0	0	0	0	0	4
Compliance and regulatory risk (2)	1	1	1	1	1	1	1	0	0	7
Opportunistic risk (6)	1	1	1	1	1	1	1	0	0	7
Organization Structural risk (7)	1	1	1	1	1	1	1	0	0	7
Risk due to cultural differences (5)	1	1	1	1	1	1	1	1	0	8
Political risk (3)	1	1	1	1	1	1	1	1	1	9
Dependence	9	9	9	9	5	5	5	2	1	

4.7. Development of diagraph

Based on the conical matrix an initial diagraph including transitivity links is drawn. This is drawn by the nodes and the lines of edges. After removing the transitivity, a final diagraph is drawn (Figure 2). If there is a relationship between the risks j and i this is shown by an arrow which points from risk i to risk j.

4.8. Development of ISM model

The diagraph is converted into an ISM model by replacing the nodes with name of risks as shown in Figure 3.

4.9. MICMAC analysis

Matrice d'Impacts croises-multipication appliqu´ean classment (cross-impact matrix multiplication applied to classification) is abbreviated as MICMAC. The MICMAC principle is based on the multiplication properties of matrices. The purpose of a MICMAC analysis is to analyze the driver power and dependency of the variables (Raj *et al.*, 2008; Govindan *et al.*, 2012). This is done to identify the key risks that drive the system. Based on their driver power and dependency, the risks, in this present case, have been classified into four categories as follow:

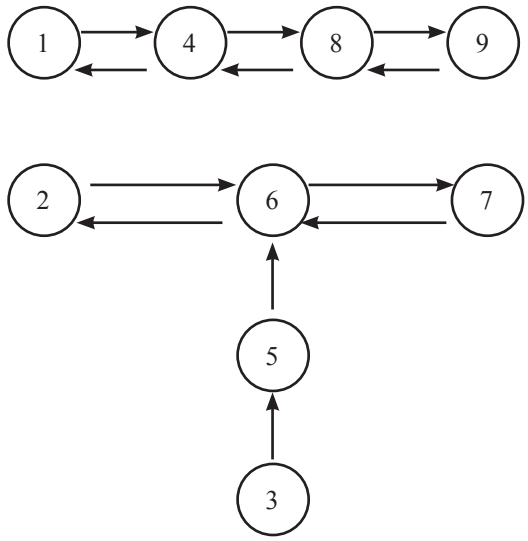

Figure 2. Diagraph showing the level of offshore outsourcing risks

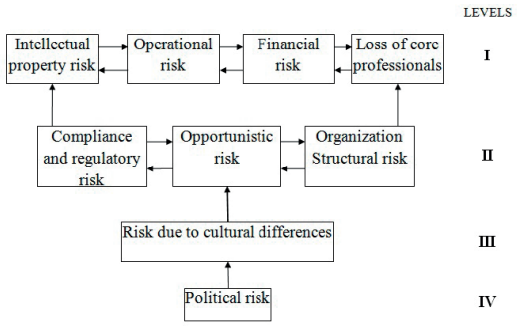

Figure 3. ISM model showing the level of offshore outsourcing risks.

(1) Autonomous risks: These risks have weak driver power and weak dependence. They are relatively disconnected from the system, with which they have few strong links.

(2) Linkage risks: These have strong driver power as well as strong dependence. They are also unstable. Any action on them has an effect on others and also a feedback effect on themselves.

(3) Dependent risks: This category includes those risks which have strong dependence power but weak driver power.

(4) Independent risks: These have strong driver power but weak dependence power. It is generally observed that a risk with a very strong driver power, called a 'key risk' falls into the category of independent or linkage risks. Figure 4, presents the results of MICMAC analysis.

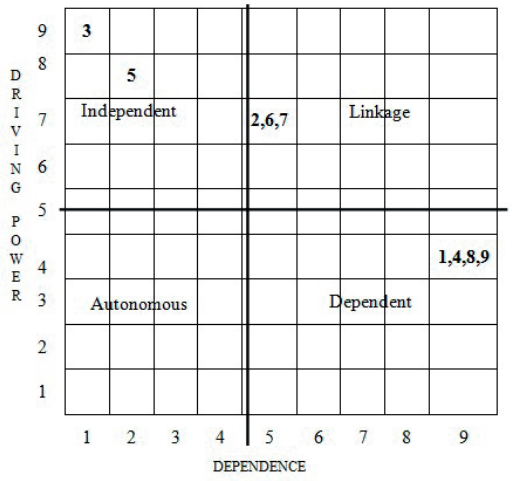

Figure 4. Driving power and dependence diagram.

5. Findings and discussion

The objective of this research was to identify and analyze the risks that significantly affect success of offshore outsourcing so that managers may effectively deal with these risks. In this research, an ISM-based model was developed to analyze the relationship among different risks of offshore outsourcing so that management can get an insight into these risks and understand their relative importance and interactions. Some of the valuable findings from the study are as under:

(a.) From the driving power and dependence diagram (Figure 4), it is observed that two risks,

namely political risk (3) and risk due to cultural differences (5) have strong driving power and are less dependent on other risks. Therefore, these all independent variables are strong drivers and may be treated as the root causes for all risks, so managers need to address these risks as a priority for success of offshore outsourcing.

(b.) From the driving power and dependence diagram (Figure 4) it is observed that intellectual property risk (1), operational risk (4), financial risk (8) and loss of core professionals (9) are weak drivers but strongly dependent on the other risks. These four risks are at the top of the ISM hierarchy, therefore are considered as the most important risks. Decision taking authorities should, therefore, accord high priority in resolving these risks for achieving success of offshore outsourcing and should understand the dependence of these risks on other risks. Operational risks are caused by the breakdown in operations at the vendor location. These risks are not caused by deliberate actions by the vendor or by unethical behavior of the vendor. Rather, they are a by-product of the complexity of operations, the geographic separation between client and vendor, the cultural gap between the environments of the client and the vendor, or the limitations of the communications and transmission systems between the two (Aron *et al.*, 2005; Krishnamurthy *et al.*, 2009).

6. Conclusion

Based upon the extant review of literature, authors identified 9 key risks that could affect performance of offshore outsourcing. Further to examine the complex relationship between them, an ISM model and MICMAC approach was used. The findings provide important classification of risks under four categories i.e. independent (risk due to cultural differences and political risk), linkage (compliance and regulatory risk, opportunistic risk and organization structural risk), dependent (intellectual property risk, operational risk, financial risk and loss of core professionals) and autonomous (no risk in this case). The results obtained with the help of ISM are being used to gain insights into the driver and dependence power of risks related to offshore outsourcing.

Future research may be directed towards confirmatory approach to data analysis supported by structural equation modelling (SEM) and inclusion of more risks which affect the process of offshore outsourcing.

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