On Assessment of Risks in Offshore Outsourcing of Information Technology

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Abstract

The paper proposes a systemic framework for assessment of Information Technology risks in offshore outsourcing projects based on the Analytic Hierarchy Process. The authors provide an analysis of current literature on IT risks in outsourcing, software project development and offshoring in order to illustrate the many facets of IT offshoring risks. The features of the framework and its elements are discussed as well.

Keywords: IT risks, offshore outsourcing, offshoring risks, MCDA, AHP, ANP

1. INTRODUCTION

According to Oshri, Kotlarsky and Wilcocks (2015) a conservative estimate for the global outsourcing contract value of business and Information Technology (IT) services exceeded US$700 Billion by the end of 2014 while it was only about US$10 Billion in 1989. The importance of outsourcing as a topic has generated much research, focused originally on domestic outsourcing (see Dibbern et al., 2004) and for the last decade also on offshore outsourcing (see Gonzalez et al., 2013). According to Oshri et al. (2015:3) "sourcing is the act through work is contracted or delegated to an external or internal entity that could be physically located anywhere. It encompasses various insourcing (keeping the work in-house) and outsourcing arrangements such as offshore outsourcing (when the work is outsourced to a third party), captive outsourcing (when the work is performed by a subsidiary of the same organization located on another continent), nearshoring (when the work is performed in a neighboring country like Mexico) and onshoring (work is outsourced within the same country). A common method for identifying and managing risk is through the use of checklists (Nakatsu & Iacovou, 2009:57). This however does not take into account the relative importance of risks and provides little opportunity for analysis of risks.

Davis et al. (2006:741) define offshoring as "the provision of organizational products and services from locations in other countries, whether they are actually overseas or not." Since 2005 there is a greater focus on offshore outsourcing (see Lacity et al., 2009), Persson and Schlichter (2015)) as opposed to traditional domestic outsourcing (onshoring). The most

comprehensive analysis of outsourcing research and practice is presented in Dibbern et al. (2004). They have explored in depth the outsourcing decision (whether to outsource or not), the reasons for outsourcing, what business activities in IT are being outsourced, how firms outsource and the outcomes of outsourcing and their measurement. These research issues are applicable also to offshoring. According to Gonzalez et al. (2013:230), "the geographical as well as cultural distance which often exists between clients and providers of these services leads to the emergence of several risks which are specific to Offshore Outsourcing, such as those derived from having to battle with various time zones, different legislations or additional security and privacy problems. For this reason, an enterprise will only decide to venture into this new business area if it has additional incentives…". Lacity et al. (2009:140) conclude that researchers have found that offshore outsourcing poses considerably more challenges than domestic outsourcing. These are associated with various risks, some of which are related to the factors listed above.

There have been special issues on IT Offshoring of leading IS journals like MIS Quarterly (see King & Torkzadeh, 2008), Journal of Global Information Technology Management (see Goodman & Ramer, 2007), Journal of Information Technology (see Oshri & Kotlarsky, 2008) and others but papers on evaluation of risks in IT offshoring have only occasionally appeared mainly in Operations Research journals. That is contrasting also with the fact that the topic of IT offshoring risks is ranked as the second most often researched topic in the empirical Information Systems offshoring literature according to Gonzalez et al (2013).

Risk areas represent organizational contexts that include many related risk factors, which together possess a threat to a software development project's success (Boehm, 1991). Research on IT offshoring risks is quite diverse. A good review on IT risks can be found in Pfleeger(2000). Early analysis of major aspects of IT offshoring is provided in Davis et al. (2006). Chatfield and Wanniniaka (2008) have investigated IT offshoring risks and governance capabilities. The cost of risk in offshore systems development is explored in De Hondt and Nezlek (2009). The nature of offshoring and the dangers from it are analyzed in Hirschheim (2006), Herath and Kishore (2009) and elsewhere. A framework for managing IT offshoring including risk mitigation is provided in King (2008). A detailed analysis of risks in global software engineering is provided in Venter et al. (2012). An investigation of the effects of different relational norms on the link between behavioral risks and offshore software development success is presented in Matthew and Chen (2013). A case study on managing risk areas in IT offshoring is presented in Persson and Schlichter (2015). The above list on references dealing with aspects of offshoring risks is by no means comprehensive and more sources can be found in several review papers mentioned later.
While some of the above mentioned papers deal with risks in IT offshoring, those are mainly discussed as checklists and with respect to proposed risk mitigating measures. These are most often isolated to several risks like Davis et al. (2005) or on the other hand related to uncategorized large lists of risks like in Sakhtivel (2007) which makes their use in real decision making by practitioners difficult. Some papers deal with offshoring risks from the point of view of the client while others are dealing with IT offshoring risks from the point of view of the service provider (see Taylor,2005). Sourcing risks have been also explored from practitioner perspectives as in Bunker et al. (2015). Other previous research has focused just on IS development risks or on operational risks only. A real IS project success cannot be achieved by managing one type of risks and hence we need an integrated approach for assessment of IT offshoring risks for improved decision making in offshore IT outsourcing management.

Gonzalez et al (2013) do not investigate the nature of the risk factors and how they can be used in decision making. Their findings show that Decision making is ranked only ninth in the list of 13 research topics on IT offshoring derived from the journals analyzed by them and that it is the subject of only 8 papers out of a total of 127 (see Gonzalez et al. ,2013).

While a few published papers deal with prioritization of risks in offshoring in other industries, there are almost no papers dealing with a systemic evaluation of the importance of specific offshoring risks in the context of a particular software project. Previous research on Multi-Criteria Decision Making (MCDM) applications to other outsourcing problems concludes that publications on MCDM modeling in outsourcing do not utilize completely the richness of findings from the empirical IS literature related to the problem (see Petkov & Petkova, 2010). That provides a link to the previous conclusion for the need of an integrated systemic approach to

evaluation of IT offshoring risks. These are among the main motivations of this research.

The goal of this paper is to provide a systemic framework for assessment of risks in IT offshoring services based on MCDM within the context of a specific project. We exclude from our focus however the area of Business Process Outsourcing (taking almost half of the market value of global outsourcing mentioned earlier).

Typically risk management involves three steps:

1. risk identification,
2. risk assessment and
3. risk mitigation.

Risk mitigation issues are outside the scope of this paper. The second section proceeds with an analysis of what can be learned from past research on software risks, including those associated with IT outsourcing, systems development and offshoring. It is followed in the third section by an attempt to address the second step above through the formulation of a systemic framework for assessment of IT offshore outsourcing risks and a conclusion.

2. ON SOFTWARE OFFSHORING RISKS

Risks in Information Technology represent a multifaceted research area that is closely related to other fields like IT failure (including project development and operational failure), project success etc. IT offshoring project risks may be applicable to all types of projects and on the other hand may be specific only to specific offshore outsourcing projects depending on their context. IT offshoring risks overlap also with risks in some global or distributed software development projects. Sometimes the notion of risks is replaced by the notion of barriers for software project success but the meaning of that is very similar to risks. IT risks may play a role only in specific project contexts and hence there cannot be a universal list of risks applicable to every situation. Therefore IT offshoring risks are a very complex notion related to the more general notions of IT risks, IT outsourcing risks, IT project success, IT project failure, global or distributed software development and IT operations. IT offshoring risks are important because their understanding and evaluation can lead to better chances for their mitigation.

We will deal in this section with the identification of the types of IT offshoring risks. One possibility is to treat that question starting from the broader notion of IT Outsourcing. Another option is to take as a leading point the even broader area of IT development and operations or a third one is to follow a more narrow perspective associated with factors that relate only to offshoring. We will explore each of these options separately below.

IT offshoring risks derived from studies of IT outsourcing

One of the early widely cited papers on risks in IT outsourcing by Earl(1996) considers the following types of risks in IT outsourcing: possibility of weak management, inexperienced staff, business uncertainty, outdated technology skills, endemic uncertainty as IT project development and operations have been always uncertain, hidden costs, lack of organizational learning, loss of innovative capacity, dangers of an eternal triangle involving the client, the outsourcing provider and the business analysts serving as intermediaries in the project, technology indivisibility, and fuzzy focus of outsourcing only on the supply side of IT and not on other aspects like generating new application ideas or harvesting the benefits of IT.

A more elaborate list of 18 outsourcing risk factors grouped in 10 categories is presented in Dibbern et al. (2004) which extends the work of Earl (1996) with results from several other authors from the field of Management and other areas.

Bahli and Rivard (2005) divided IT Outsourcing risk factors into two groups; (a) factors associated with the transaction (Asset specificity; Small number of suppliers; Uncertainty; Relatedness between business units and functions; Measurement problems), and (b) factors related to the client and the supplier (Degree of expertise with the IT operation; Degree of expertise with outsourcing).

Lacity et al. (2009) provide a much larger list of 28 IT outsourcing risks based on analysis of published research in journals. While that list is more informative about the types of outsourcing risks it is not very practical for decision making because of the lack of grouping of factors and the difficulty of humans to differentiate between more than seven plus or minus two objects as was found by psychologist George Miller in 1956, a fact used by Saaty (1990) to establish some of the concepts for structuring decision problems in the Analytic Hierarchy Process (AHP) and later the Analytic Network Process (ANP).

The most comprehensive catalog of outsourcing risks to date is presented in de Sà-Soares, Soares

and Arnaud (2014). It is again based on analysis of previously published research. They create a very detailed list of outsourcing risks, undesirable consequences and customer-related negative outcomes from outsourcing with the hope that those are initial steps in creating a theory explaining outsourcing risks.
Next will be discussed sources from systems development coming both from the Information Systems field and from Software Engineering.

Offshoring risks derived from research in IT systems development
Software engineering risk management emerged in the 1980s and its principles were summarized in Boehm (1991) and several earlier publications by the same author.

The first empirically validated list of risk factors in software development projects was generated through a Delphi survey by Schmidt et al. (2001). They were grouped in 14 categories. The risk factors were shown by rank order and that was another major difference of those results from prior findings of other authors. These authors claim to contribute to the unification of research on risk management and software project management. Their results have been used subsequently by outsourcing researchers like Taylor (2005) and others.

The most exhaustive research on risk factors in global software project management is probably presented in the detailed report by Verner et al.(2012). They analyzed 24 systematic literature reviews of global software development and generated a list of risk factors in 10 groups. However, no justification is provided for the way how the groups were chosen and their results do not have the empirical validation of the findings of Schmidt et al. (2001).

A typical weakness of the literature associated with risk management in IT is the separation of risks in software development from the operational risks. That led Markus(2000) to propose an integrated approach treating both types of risks. From that point of view she defines IT-related risk as "the likelihood that an organization will experience a significant negative effect (e.g., technical, financial, human, operational, or business loss) in the course of acquiring, deploying, and using (i.e., maintaining, enhancing, etc.) information technology either internally or externally (i.e., facing customers, suppliers, the public, etc.)." Markus (2000) defines IT related risk as "*anything* related to IT that could have significant negative effects on the business or its environment from the perspective of an executive investing in IT" and proposes a typology of 10 types of risks based on prior research on software development risks. Those however are not reflecting well the specifics of offshore software development which will be discussed more in the next subsection.

Offshoring risks derived from studies of IT offshoring
Some authors like Davis et al. (2005) and King (2008) provide small lists of IT offshoring risks based on expert opinion or on speculation or anecdote evidence in the words of Nakatsu and Iacovou (2009:58). The first empirically validated list of IT offshoring risks through a Delphi study was developed by Nakatsu and Iacovou (2009). They attempted a synthesis of findings in the outsourcing field and on software development and considered initially an analysis of published literature on IT outsourcing. As a result, they provide a comparative analysis of risks in outsourcing. Using as a starting point Earl (1996) and other sources, they summarize 36 risks in outsourcing in the following 11 groups: Client capabilities, Vendor capabilities Vendor–client communications, Contract management, Strategic risks, Legal/regulatory, Security, Financial, Geopolitical, Firm reputation/employee morale, Technology risks, Noncompliance with embraced development methodologies, Incompatible development tools.

Nakatsu and Iacovou (2009) investigated also the project management literature and generated further a summary of risk factors derived from it. That list consists of 24 risk factors categorized in six groups: Team-related (Staff turnover, Lack of team communication, Lack of required technical and business knowledge, Lack of motivation, Team conflicts); Organizational environment (Lack of top management support, Organizational politics, Stability of organizational environment, Changes in organizational priorities); Requirements (Original set of requirements is miscommunicated, Continually changing system requirements, Unclear system requirements);Planning and control (Lack of project management know-how, Poor planning of schedules and budget, Poor change controls, Failure to consider all costs); User-related(Lack of adequate user involvement, Failure to gain user commitment, Failure to manage end-user expectations, Conflicts between user departments) Project complexity (Difficulties with integration, Large number of links to other systems, Processes being automated are

complex, Inadequate understanding of new technology).

The above findings were used by Nakatsu and Iacovou (2009) as a baseline for their Delphi study on risk factors in IT offshoring projects which identified 25 factors applicable to IT offshoring. As a result, they identified the following unique IT risk factors that are special to offshore outsourcing:

- Language barriers in project communications;
- Cross-national cultural difference;
- Constraints due to time-zone difference;
- Unfamiliarity with international and foreign contract law;.
- Political instability in offshore destinations;
- Negative impact on image of client organization;
- Currency fluctuation.

Since their approach produced also through the Delphi study rankings of the risk factors, Nakatsu and Iacovou (2008:64) concluded that with the exception language barriers in project communications none of these risks were ranked very highly in importance by the Delphi panel. Such findings are valuable for gaining general understanding of risks in software development but they do not apply strictly to the context of a specific software project.

Chatfield and Wanninayaka (2008) used also previously published research to generate a list of risk factors in IT offshoring that are in three groups: 22 client related risks, 20 Vendor related risks and 6 inter-firm relationship risks. Aundhe and Mathew (2009) have investigated the risks in IT offshoring from the provider perspective using a case study while Abdullah and Verner (2012) analyzed similar risks but from the client perspective.

A comprehensive list of 18 IT offshoring risks and risk mitigation practices is discussed in Sakhtivel (2007). Another feature of that research is the comparison of the level of risk in two extreme cases of IT offshoring – having a single vendor as an outsourcing provider and own subsidiary located overseas as the offshore developer.

Persson and Schichter (2015) present a case study in which they explore how a company manages the following risk areas: task distribution, knowledge management, geographical distribution, collaboration structure, cultural distribution, stakeholder relations, communication infrastructure, and technology setup. Their findings are interesting because as a way to limit the impact of subjectivity introduced by the personal opinions of the managers involved in the study the researchers worked with a client company that had achieved level 5 maturity in the Integrated Capability Maturity Model (CMMI). Achieving CMMI certification in the client organization is a best practice in offshoring for closing the process gap between a client and its supplier organizations (Rottman & Lacity, 2006). Another important aspect of their study is that the risk areas are positioned within the four basic socio-technical components of organizational change (task, structure, actors, and technology). As a result, the recommended risk meditation strategies in Persson and Schichter (2015) are presented in a clearer way.

So far we have provided analysis of past research on outsourcing and offshoring risks. The next section will explore the proposed framework for assessment of IT offshoring risks

3. ON A SYSTEMIC FRAMEWORK FOR ASSESSMENT OF IT OFFSHORING RISKS

The proposed framework for assessment of IT offshoring risks is systemic because it fulfills the criterion for systemicity that all factors need to be considered with their inter-relationships in the context of the particular software project (see Midgley,2011). The systemicity of the framework will be supported by the choice of a hard systems thinking approach for modeling and assessing the risk factors through the Analytic Hierarchy Process(AHP), a Multi Criteria Decision Analysis (MCDA) method suggested by Saaty in the late 1970s (Saaty,1990 and Saaty, 2005). Saaty indicated that his method can be used as a systems approach in the early 1980s. The features of MCDA as a systemic approach were analyzed further in Petkov and Petkova (1998). More details on the theory of AHP and its extension, Analytic Network Process (ANP), their applications and suitability for various problems can be found in Saaty (1990) and Saaty (2005). We will mention here only a few characteristics that support the claim that AHP and ANP support systems modeling:

- Both AHP and ANP support decision models that aim at prioritizing the factors, in our case IT offshoring risks. Hence the models created with them can be seen as purposeful systems themselves and they support the

purposeful system of assessing along multiple criteria the relative importance of IT offshoring risks.

- AHP models a problem in the form of a hierarchy, a useful construct to handle the complexity in systems, while ANP models a problem like assessment of offshoring risk factors as a network which is suitable when there are interdependencies between risk factors.
- Both AHP and ANP allow the measurement of pairwise importance of the IT offshoring risk factors involved in the models using a ratio scale that can convert both quantitative and qualitative variables to numbers representing human judgment about the risks involved.

The proposed framework for assessment of IT offshoring risks is presented in figure 1 below.

Exploration of IT project context and its stakeholders
Expert evaluation of the project tasks, structural components (including country features), technology and their relationships
Generation of a list of appropriate risk factors
AHP/ANP prioritization of the IT offshoring risks in the context of the project

Fig.1 Proposed framework for assessment of IT offshoring risks in a particular project context

The understanding of the project context in the first step of the framework is developed through analysis of the stakeholders and their interests along the considerations in Petkov, Petkova and Andrew (2013). The second step involves data gathering and traditional systems analysis activities about the nature of the offshoring work to be analyzed. The third step will be based on expert opinion on the set of relevant risks for the project developed as a subset from a checklist of offshoring risks generated on the basis of previous research discussed in section 2 above. The last step involves the generation of an AHP or ANP model using available software like Super Decisions (www.superdecisions.com), Expert Choice (www.expertchoice.com) or others.

The issue of modeling risk in AHP is slightly controversial. Saaty (1990) recommends the use of AHP prioritization for calculating Benefit/Cost, Benefit/Risk or Benefit/[Cost*Risk] ratios as a way of modeling risk. This has been shown as a problematic solution by Millet and Wedley (2003) who propose the direct use of risks as criteria in the prioritization hierarchy or the use of risk as an adjustment factor for costs or benefits. In the proposed framework we assume that types of risks will be used directly as criteria along with Millet and Wedley (2003).

Further use of AHP in decision making on other problems in outsourcing is illustrated in Liu et al. (2009), Petkov and Petkova (2010) and elsewhere and will not be discussed here for space reasons. More details on AHP modeling can be found in the papers analyzed in a review of the application of AHP in the related field of Operations Management by Subramanian and Ramanathan (2012).

4. CONCLUSION

We analyzed in this paper what is known from past research on IT offshore outsourcing risks which is a highly important topic in IT offshoring according to Gonzalez et al. (2013). The understanding of those risks was developed through investigation of findings of previous publications on IT outsourcing risks, software development project risks and from studies of IT offshoring risks. That knowledge base was combined with the past experience of the authors in multicriteria decision analysis for the purpose of formulating a systemic framework for assessment of IT offshoring risk factors in the context of a specific project. To the best knowledge of the authors there is no published account of a systemic framework for prioritizing of risks in IT offshoring risks using a multicriteria approach like AHP or ANP and hence the theoretical contribution of this paper. This conceptual paper has a limitation as the practical illustration of the proposed framework is not demonstrated here. Possible directions for further work include the practical application of the framework using the Analytic Hierarchy Process as a prioritization method, modeling potential dependencies between the risk factors using the Analytic Network Process and automation of the steps in identifying the risk factors to be included in the model through software project context analysis. The proposed framework is a step in improving the practice of IT offshore outsourcing risk management.

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