

A Review of Critical Success Factors for Offshore Software Development Projects

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Offshore project success is very much important to both customer and the vendor. Based on very less success rate of overall software projects globally, critical success factors (CSFs) for offshore software projects is gaining much importance. In the current study based on literature review, a total of 75 success factors for offshore software projects are identified. Further based on their appearance in literature 20 critical success factors from 10 CSF categories are identified. Finally top six most critical success factors for offshore software projects such as *trust*, *efficient communication*, *cultural understanding*, *relationship between client and vendor*, *contract type* and *efficient knowledge transfer* are identified. The CSFs categories are prioritized in the order of importance. The important CSF categories for offshore projects found are organizational factors (both client and vendor), project factors, cultural factors and environmental factors.

Keywords: Critical Success Factors, Software Projects, Project Success, Information Systems Projects, Offshore Software Projects

1 Introduction

According to Standish Group CHAOS Research report (2009), only 32% of the software projects are successful. 44% of the software projects are challenged by cost or schedule overruns and 24% of the projects are failed and did not reach the project objective. That means overall 68% of the software projects are either failed or challenged. The success rate of the software projects is relatively less to compare with other industry projects. Because of the very less percentage of success rate in software projects, *Project Success* became a topic of research for many researchers across the world. There are many factors such as technical factors, cultural factors, environmental, legal and social factors affecting the success of offshore software projects in offshore provider countries such as India, China, Ireland, Philippines, Taiwan, Singapore, Hong Kong, Malaysia, Israel, Brazil, Russia, Mexico, South Africa, Hungary and Czech Republic. More than 50% of the Fortune 500 organizations are going for off-shoring their software projects (Hirschheim et al., 2004; Avison and Torkzadeh, 2009). GE, American Express, Walmart, and Kodak have benefited from offshoring their software projects (Avison and Torkzadeh, 2009).

The business of software development is becoming global in nature (Eberlein, 2008). For example, Boeing 787 Dreamliner project brings together 50 global partners work-

ing in over 130 locations across the globe (Witthaus, 2008). Globalization and opening up of different global markets and the global dispersed nature of software work are increasing the offshore software market (Philip et al., 2010). According to McCarthy (2007), a Forrester research report, 65% of the US and European organizations have minimum of 1000 offshore project employees working for them in offshore providing countries (Philip et al., 2010). This indicates the growth of offshore industry.

IT organizations are using global human resources to reduce costs and for quality (Eberlein, 2008). Usually offshore provider can be a wholly owned subsidiary, partially owned subsidiary or an entirely external service provider (Westner and Strahringer, 2008; Westner, 2009; Westner and Strahringer, 2010). According to Westner and Strahringer (2010), Offshoring happens from a physically dispersed geographical location, different time zone and different culture. IT offshore business is lead by India, followed by China and other near shore countries such as Eastern European countries. Indian offshore industry has maintained double digit growth rate for almost two decades. Russian offshore industry is also growing with strong technical skills, methodologies, and high education levels in Mathematics and Science backgrounds (Kolding and Kroa, 2007). With advancements in telecommunications infrastructure across the world, organizations are following the sun in their offshore software services delivery

(Jennex and Adalakun, 2003; Gengler, 2003; Hirschheim et al., 2004; Kolding and Kroa, 2007; Adalakun, 2008; Mechitov, 2008; Remus and Wiener, 2009). Organizations such as IBM, HP, Accenture, CapGemini, SAP, and Oracle have off-shored their work to many offshore service providers in Asia. The off-shoring trend has increased since the Y2K and Euro currency transition (Adalakun, 2008).

The exhaustive literature for this current study was collected from journals such as *MIS Quarterly*, *MIS Quarterly Executive*, *International Journal of Project Management*, *Project Management Journal*, *Information & Management*, *Journal of Information Technology Management*, *Journal of Global Information Technology Management*, *Journal of Information Technology Cases and Applications*, *Communications of IBIMA*, *Information & Management*, *Sprouts: Working Papers on Information Systems*, *Journal of Information Technology Research*, *Indian Journal of Economics and Business*, *African Journal of Business Management*, *International Journal of Reviews in Computing*, *Journal of Universal Computer Science* and *Electronic Journal on Information Systems in Developing Countries*. The literature review was carried out during February 2012 and April 2012, research design/model was done during May 2012 and July 2012, analysis of success factors and finding the research results was done during August 2012 and September 2012 and report writing was carried out from October 2012 to November 2012.

This paper is organized as, next section deals with why organizations go for off-shoring?, section-3 deals with research question, section-4 has exhaustive literature review, section-5 draws the conceptual model, section-6 explains the research methodology followed, section-7 has analysis of success factors, section-8 analysis of findings, discussion and comparison with previous studies and section-9 deals with limitations of current research, further research scope and implications for both industry and research community.

2 Why Organizations go for Off-shoring?

Organizations go for off-shoring because of cost reductions/advantages (Jennex and Adalakun, 2003; Prikladnicki et al., 2004; Hirschheim et al., 2004; Amberg and Wiener, 2006; Beverakis et al., 2007; Adalakun, 2008; DeHondt and Knapp, 2008; Raisinghani et al., 2008; Remus and Wiener, 2009; Avison and Torkzadeh, 2009; Patel et al. 2009; Nassimbeni et al., 2010; Philip et al., 2010; Capatina et al., 2011; Gold, Undated, 1a), differentiation, availability of global talent pool (Gengler, 2003; Hirschheim et al., 2004; Amberg and Wiener, 2006; Raisinghani et al., 2008; Remus and Wiener, 2009; Avison and Torkzadeh, 2009; Patel et al., 2009), cheap labor in developing countries (Gengler, 2003; Hirschheim et al., 2004; Patel et al., 2009), reduced time to market (Raisinghani et al., 2008; Remus and Wiener, 2009), efficiencies, flexibility in product delivery (Kolding and Kroa, 2007; Nassimbeni et al., 2010), access to new technologies, resources and skills (Jennex and Adalakun, 2003; Hirschheim et al., 2004; Adalakun, 2008; Raisinghani et al., 2008), focus

on core competencies (Beverakis et al., 2007; Raisinghani et al., 2008; Avison and Torkzadeh, 2009), access to new markets (Prikladnicki et al., 2004), competitive advantage, operational reasons, economic reasons (Jennex and Adalakun, 2003; Adalakun, 2008; Avison and Torkzadeh, 2009; Nassimbeni et al., 2010), time zone advantages (Raisinghani et al., 2008), round the clock services (Hirschheim et al., 2004; Raisinghani et al., 2008) and in current days for the quality of work (Eberlein, 2008). The high labor costs in western countries and cost savings are also leading to offshoring the software projects to Asian and Eastern European countries where the development costs are relatively less (Westner, 2009; Westner and Strahringer, 2010). According to Westner and Strahringer (2010), German companies have faced difficulty in offshoring software projects because of language and cultural barriers. In the initial days of offshore industry growing number of global organizations have reported disappointments and failures of offshore projects (Ranganathan and Balaji, 2007). Thus, there is need for and importance of this area to be studied and researched. Current day organizations are looking in offshore providers not only cost advantages they are providing but also their stability and attrition rates (Kolding and Kroa, 2007). Offshoring has changed the way software products are designed, constructed, tested and deployed (Prikladnicki et al., 2004).

Organizations see for certain criteria in offshore service provider while going for offshoring such as their reputation, list of clients, CMM (Capability Maturity Model) level, references (Ranganathan and Balaji, 2007), information systems security (Nassimbeni et al., 2010), business strategies (Hirschheim et al., 2004; Beverakis et al., 2007), national culture, organizational culture, HR policies, quality initiatives and attrition rates (Witthaus, 2008). According to Westner and Strahringer (2008), organizations choose projects for offshoring based on the project size, codification, business criticality, project complexity, costs, intellectual property, labor intensity, requirements stability, strategic importance, technological availability and the language (Capatina et al., 2011) spoken at offshore service provider. The software projects to be offshored should have significant duration and significant size to offshore (Westner and Strahringer, 2008). Extensive coding prone projects are more suitable for off-shoring. Low complexity and highly modular projects are suitable for off-shoring (Westner and Strahringer, 2008).

Offshoring phenomenon has mixed response in the world (Marcon and Gopal, 2004). Offshore development is labor intensive, complex, technology intensive, knowledge intensive (Mathrani et al., 2005), multi disciplinary and requires lot of information flow (Dyrhaug et al., 2003). Risks are not removed totally when organizations go for off-shoring. There exists little empirical evidence in the literature which shows the cost reductions with offshoring (DeHondt and Knapp, 2008). In fact, new set of risks get added because of cultural, language and time zone issues requiring more rigorous risk managements for offshore software projects (Eberlein, 2008). The complexity of project work increases because the teams are geographically distributed in different parts of the world (Westner and Strahringer, 2010). Sometimes offshoring may lead to layoffs at client location (Remus and Wiener, 2009),

or transfer some of the employees to vendor organization and become contractors to the client organization. Overall it leads to lot of restructuring and change of roles and responsibilities at client location (Ranganathan and Outlay, 2009) and sometimes brings in lot of confusion and ambiguity in role and responsibilities because of introduction of vendor employees into the project. Other concerns of off-shoring include data thefts, cyber crimes, intellectual property issues, network security issues and political climate (Mechitov, 2008).

The IT offshoring leading to resizing the client staff may lead to low morale, stress, reduced commitment, loss of trust, anxiety and resentment in retained employees at client location (Ranganathan and Outlay, 2009). According to DeHondt and Knapp (2008), offshoring software work brings in additional costs such as lock-in, knowledge transfer costs,

technology transfer costs, transition costs, legal and liability costs, vendor management costs and cultural adaptation. Thus the CIOs (Chief Information Officers) and CTOs (Chief Technology Officers) have to make offshoring as a strategic long term plan rather than a tactical activity. They should very clearly communicate the roles and responsibilities of the individuals in the team (Ranganathan and Outlay, 2009). Also the customer organizations maintain a pool of offshore service providers to reduce the costs, and bring in competition among service providers and for high performance and high quality levels (DeHondt and Knapp, 2008). According to Hirschheim et al. (2004) the challenges of offshoring software projects include cultural factors, infrastructure and security issues, geographical distances, morale and public opinion. Overall

Table 1: Previous research studies on CSFs for Offshore Software Projects

Researcher(s)	Study Type (Literature Review/ Conceptual/ Empirical/Case Study)	Sample Size	Research Techniques Used (Questionnaire/Interviews/ Observation)	Number of CSFs Recommended
Jennex and Adelakun (2003)	Literature Review + Empirical study	210 respondents	Questionnaire	31 CSFs -> 6 Key CSFs
Dyrhaug et al. (2003)	Case study	2 projects	Semi-structured Interviews	11
Prikladnicki et al. (2004)	Case study	1 organization	Interviews	6
Mathrani et al. (2005)	Case study	3 organizations	Interviews	19
Amberg and Wiener (2006)	Literature review	22 interviews	Interviews	29
Huang and Trauth (2007)	Empirical study	12 Interviews	Semi-structured Interviews	3
Ranganathan and Balaji (2007)	Empirical study + Case study	18 companies	Focus Group Discussions+ Interviews	10
Adelakun(2008)	Conceptual	23 references	Literature Review	32
DeHondt and Knapp (2008)	Conceptual	41 references	Literature Review	8
Eberlein (2008)	Empirical study	15 Interviews	Semi-structured Interviews + Questionnaire	2
Raisinghani et al., 2008	Conceptual	47 references	Literature Review	5
Westner (2009)	Empirical/Quantitative research	47 Interviews	Questionnaire + Interviews	5
Rai et al. (2009)	Empirical study	155 projects	Field study + Project Database	15
Remus and Wiener (2009)	Literature Review + Case Study	103 respondents + 22 interviews	Questionnaire + Interviews	29
Westner and Strahinger (2010)	Empirical study	304 respondents	Questionnaire	5
Gold (Undated, 1a)	Conceptual	1 person + 9 ref- erences	Opinion based	6

offshore software development reduces the costs of software application development (Jennex and Adalakun, 2003).

3 Some Research Questions related to offshore software projects

The main research questions considered are:

- What are the critical success factors for offshore software projects?
- What are the categories of CSFs for offshore software projects?
- What is the conceptual model consisting of CSFs for offshore software projects and project success?

The objectives of current research include

- The research objective is to develop a conceptual model of critical success factors for offshore software development projects.
- The objective is to find the most critical success factors (CSFs) for offshore software development projects.

4 Previous Studies on Offshore Software Projects

There are very few research studies on critical success factors for offshore software projects with performing organizations perspective (Mathrani et al., 2005). One among them is the study of offshore projects from an Indian offshore service provider by Rai et al. (2009). Another research study from outsourcer's perspective is Mathrani et al. (2005). The active research on critical success factors for offshore software projects has started after 1990 even though the off-shoring was there for the past 3 decades (DeHondt and Knapp, 2008). For example, Tata Consultancy Services (TCS) of India was the early entrant in 70's into the programmers supply to US customers and later to off-shoring. There are very limited empirical studies in this area (Mathrani et al., 2005; Amberg and Wiener, 2006) and majority are opinion/practice based (Remus and Wiener, 2009) or conceptual studies (See Table 1). The research on offshoring is still in initial or theory building stage (Westner, 2009).

Carmel (2003) has suggested an "Oval model" comprising success factors for offshore software industries of different countries. Those factors are government vision, policies, technological capabilities and infrastructure, human capital, wages, industry characteristics, needed capital, quality of life and international linkages between different groups, firms and organizations. According to him, India, Ireland and Israel have already succeeded in this industry. Having internationally recognized quality certifications such as CMMi (Capability Maturity Model Integrated) and ISO (International Organization for Standards) are important for the success of offshore software industries.

Jennex and Adalakun (2003) have done an empirical study and found 31 CSFs for offshore software projects with both client and performing organization perspective. Based on the literature review five success factor groups such as people

factors, business infrastructure, technical infrastructure, regulatory interface and client interface with 31 CSFs are identified. Among these 31 factors, six factors known as telecommunications infrastructure, outsource workers technical skills, outsource workers general knowledge, client knowledge, trust, and intellectual property rights are identified as most critical success factors for offshore software projects based on empirical study. They used statistical techniques such as mean, standard deviation and ANOVA for the data analysis purpose.

Dyrhaug et al. (2003) has taken multiple case study approach with semi structured interviews to find out the critical success factors of managing offshore software projects in Norway. They have identified 11 CSF categories such as Global/Industry related, internal influences, temporal and enduring, risk abatement, performance/quality, macro environment, senior management in the company, between project organization and supporting organization, current and future, special monitoring and modification management. They ignored the project characteristics, knowledge transfer and technology transfer issues in their CSFs model.

An early study Prikladnicki et al. (2004) have done an empirical study of a Brazilian offshore software development center to find out the difficulties, solutions and critical success factors of offshore insourcing of the projects. They suggested the critical success factors such as software development process, infrastructure, training, planning and engagement, team integration, and communication for offshore projects which are insourced; that is, executed in wholly owned subsidiary in a foreign country. Sundberg and Sandberg (2004) have studied the critical success factors for an insurance project of national importance in Sweden using interviewing techniques.

Mathrani et al. (2005) have given an outsources perspective on critical success factors for offshore projects by a study based on case study approach on organizations from New Zealand and India. Amberg and Wiener (2006) have studied the critical success factors for offshore software development projects in Germany from Client organization perspective using a web based survey and interviews. They found 29 CSFs for offshore projects from customer perspective. Those CSFs come under categories such as internal suitability factors, internal management factors, external suitability factors and external management factors.

Huang and Trauth (2007) have interviewed 12 information systems professionals involved in software development work which is distributed between US and China. They observed that culture has impact on communication styles, task related conflicts are looked as opportunity for learning in information systems projects, language skills are very much important in the time of conflicts, shared corporate culture reduces team conflicts and improves team efficiency and they highlighted the importance of national culture, organizational culture and professional culture. The ambiguity and uncertain nature of software development requires informal communication in the project teams (Huang and Trauth, 2007).

Ranganathan and Balaji (2007) have done a research study on 18 companies and found 10 critical capabilities for software projects off-shoring which come under the categories such as systems thinking, global IS resource management, vendor management and IS change management. According to

them, it is best practice to execute a pilot project with offshore vendor before having a full fledged long term contract. The ratio between onsite-offshore manpower is to be maintained as 1:3 to get the cost advantages (Ranganathan and Balaji, 2007). According to Eberlein (2008), cultural awareness and management of cultural differences are critical success factors for projects of international nature. Eberlein (2008) has done an exploratory research with semi-structured interviews of experts from onshore, near-shore and offshore locations such as US, UK, India, China, Japan, Australia and Europe.

Beverakis et al. (2007) have done a case study on an MNC (Multinational Company) and identified eight categories of driving factors and challenges of offshoring IS business processes. Those categories of factors include reduce costs, become more competitive, challenges/risks, establish a global capability, skills and type of work available and targeted, location choice, management's decision and research. They observed that the organizations go for offshoring primarily to become more competitive in the market.

Adelakun (2008) has given 32 CSFs for offshore software projects and has grouped them into five groups based on literature review. He identified technical infrastructure and business infrastructure groups as offshore readiness factors and societal interface, regulatory interface and people factors as offshore attractiveness factors for software projects. Raisinghani et al. (2008) based on literature review have identified five CSFs for offshore software projects such as risk analysis; relationship management and cultural understanding; cost/benefit analysis; implementing risk controls; and understanding legal issues and contracts.

Rai et al. (2009) have done an empirical study of 155 offshore software projects from an Indian offshore provider working for US clients. They found that the organizational and interpersonal cultural differences are critical success factors for offshore software projects. They gave a offshore project success model which consists of the factors such as project leader cultural values, relational factors, vendor-client work practices, offshore leader-client cultural difference and used project characteristics as control variables. This model ignored the time zone difference factors, language factors, technology transfer factors, knowledge transfer factors and offshore team factors at large. They used customer satisfaction and cost overruns as project success measures. They observed that there is a relationship between cultural differences and offshore IS project success and also relational factors impact the offshore software project success. Cultural understanding and intelligence of offshore leader have significant impact on offshore project success.

Remus and Wiener (2009) have done a study of CSFs for offshore projects from US clients and Indian and European service providers' perspective. They have identified 29 CSFs with a CSF model having CSF categories such as internal suitability factors, internal management factors, external suitability factors and external management factors. After literature review, they have used questionnaire, interviews and case study approach to arrive at CSFs. They observed that external management factors are more important than the internal management factors for the success of offshore software projects. They identified *clear project goal* as most important CSF.

Other CSFs among most relevant CSFs are good language skills, controlling project results, appropriate project team, communication flow, high quality of offshore staff, and preparation of detailed project specification.

Westner and Strahinger (2010) have done an empirical study of 304 experts from Germany using questionnaires who is availing offshore software services. They found that the offshoring expertise, trust, project suitability, knowledge transfer, and liaison quality as critical success factors for offshore software projects. According to them, it is best practice to conduct cross cultural training programs, which will facilitate open and frequent communication before starting of real offshore projects. Westner in his (2009) paper has given a model of antecedents of offshore project success which consists of the components such as offshore expertise, trust, impacting project suitability, knowledge transfer and liaison quality in turn impacting the offshore project success. In this model communication factors are not highlighted much. However he has highlighted the knowledge transfer factors. This is purely customer perspective.

According to Philip et al. (2010), offshore software projects are more prone to fail because of risks in culture, language, time zone differences, communication, and knowledge transfer. Capatina et al. (2011) have done a research study using a web based platform on a Romanian software company to link the cultural intelligence with global IT projects to offshore the projects to countries such as India and Nigeria. According to Gold (Undated, 1b), the client organizations should understand the complex relationship between vendor management, contract negotiations and risk management. Project manager's leadership style and competence are important for project success (Turner and Müller, 2005).

Shahzad et al. (2011) have done a literature review and suggested a framework for offshore project success. They have identified communication, coordination, architecture, feedback as critical to offshore project success. Mathrani et al. (2012) have done research on 10 case studies in New Zealand and India to find out the impact of knowledge management initiatives and the offshore project success. In this study they found that the New Zealand managers were contributing towards project and product management and the Indian counterparts were contributing towards software construction. They found that knowledge management is also a success factor for offshore software projects.

Bapna et al. (2012) have tried to find the impact of 3rd party advisors on the relationship between contract type and outsourcing project success. They have also identified trust, interpersonal relationships and contract type impact on outsourcing project success.

5 The Proposed CSFs model for Offshore Projects

Proposed conceptual model is a multi level model as shown in Figure 1 and Figure 2. The proposed model consists of 10 CSF categories for offshore software projects. The relationships between these categories of factors are as shown in Figure

1. Cultural, language, time zone, organizational (both client and vendor) and environmental factors are connected to other CSF factors such as technology transfer, knowledge transfer, project and team factors via communication factors. All these factors in turn are connected to offshore software project success (Figure 2). The relationships between different CSF categories may be correlation, regression or just information flow as well.

The *offshore project success* is very tricky because the processes, resources, roles and responsibilities are divided between customer and the service provider (Ranganathan and Balaji, 2007). Project success is measured in terms of the triple factors of the project such as time, cost and quality (Dyrhaug et al., 2003; Eberlein, 2008; Witthaus, 2008; Westner, 2009). According to Westner and Strahringer (2010), offshore project success can be measured in terms of cost/ benefit (Mathrani et al., 2005; Westner, 2009), customer satisfaction (Dyrhaug et al., 2003; Rai et al., 2009), meeting expectations and fulfillment of psychological obligations. They also measured the offshore project success in terms of schedules, functionality, budget and quality (Mathrani et al., 2005; Westner, 2009). Researchers like Baccarini (1999) expressed that *project success* is a combination of *product success* and *project management success*. Munns and Bjeirmi (1996) expressed that the project success is the ability to satisfy the needs of the users. Selection of a suitable project, project definition and early decision making are crucial to project success.

6 Research Methodology

The current research has stages such as literature review, draw the conceptual model, analyze the identified success factors, and discuss findings and conclusions. Based on the literature review and based on number of citations of each success factor in literature, success factors for offshore software projects are gathered. These factors are further segregated into 10 different CSF categories. Under each category of CSFs, top two most cited success factor is identified as CSFs for offshore software projects. So, total 20 CSFs (10 x 2 = 20) are tabulated. Later the top-6 most important CSFs for offshore software projects are identified based on their number of citations in literature irrespective of CSF category. Further, the CSF categories are prioritized to identify which CSF categories are important for offshore software projects. This prioritization of CSF categories is done based on the sub total of all occurrences of success factors in literature specific to respective CSF category. These categories of factors impact the success of offshore software projects. Prioritizations CSFs and CSF categories is done based on the number of citations in literature.

7 Analysis of Success Factors

Belassi and Tukul (1996) have done an empirical study to find the CSFs and their impact on project performance across multiple industries. They grouped factors into four areas such as factors related to project, project management and team

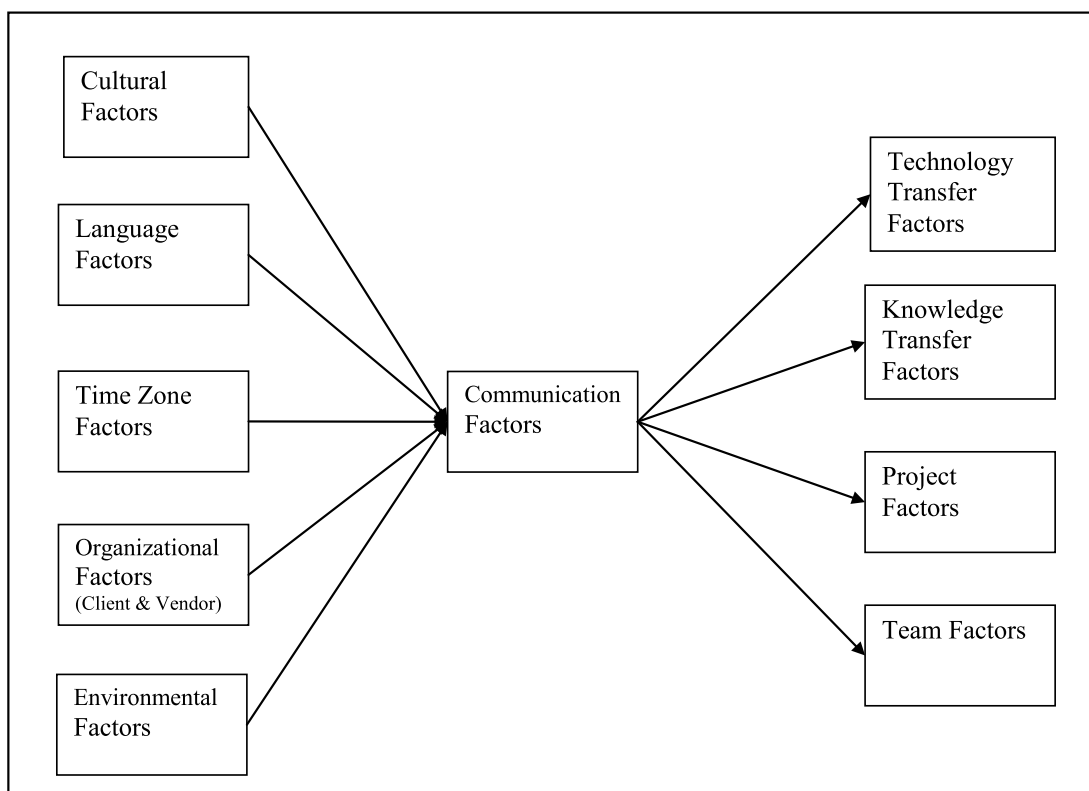


Figure 1: Relationship between CSF categories of Offshore Software Projects

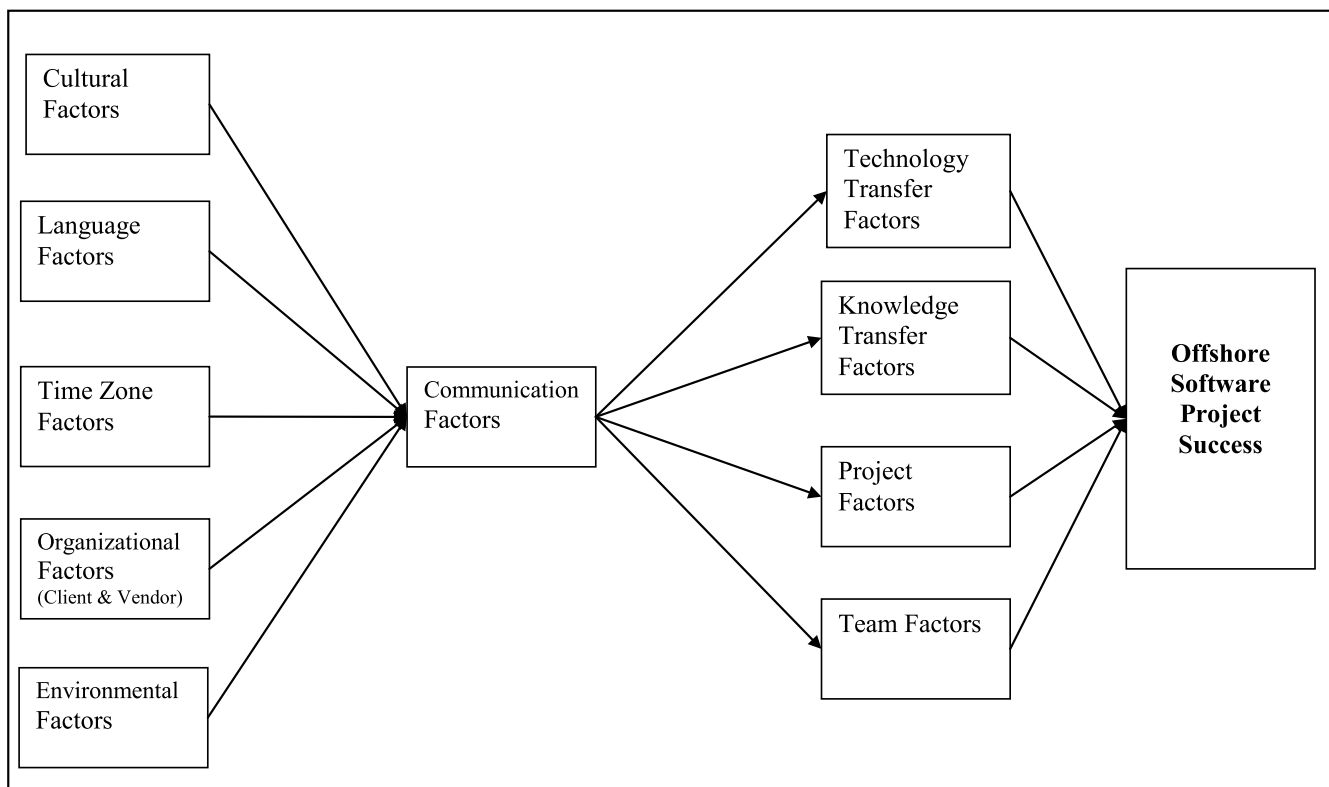


Figure 2: CSFs of Offshore Software Projects and Offshore Project Success.

members, organization and external environment. They identified the CSFs for MIS (Management Information Systems) projects as top management support, client consultation, availability of resources, initial estimates, and PM (Project Manager) performance. The CSFs groups in the order of importance for MIS projects identified were project management, environment, project, team and organization.

The critical success factor method has been used across industries and functions (Dyrhaug et al., 2003). For example, it was used in project/program management, MIS planning, MIS implementation and materials planning and management. According to Prikladnicki et al. (2004), offshoring software project work has impact on strategic, technical, knowledge management, and cultural issues. According to them the difficulties found while offshoring include language barriers, communication and cultural differences. Seventy percent of the software project requirements are difficult to identify and 54% are not well organized or clear (Prikladnicki et al., 2004). This indicates the importance of avoidance of requirements uncertainty as CSF for offshore software projects.

Offshore project success depends on the quality of relationship between client and vendor (Eberlein, 2008). According to Westner and Strahringer (2010), high level of offshore expertise, trust between vendor and offshore service provider and knowledge transfer are positively related to offshore software project success. Project characteristics such as project size, duration, programming language, degree of

coding and suitability of project for offshoring have a positive impact on offshore project success (Westner and Strahringer, 2010).

Lack of sufficient language skills leads to misunderstandings, reduced productivity, reduced quality, and increases risks of the offshore projects (Westner and Strahringer, 2008). According to Kolding and Kroa (2007), the key success factor for any offshore provider is having a list of referenced customers. The research studies on cross-cultural impact on information systems projects are very limited (Huang and Trauth, 2007). According to Huang and Trauth (2007), Cultural diversity is good for *innovation* and *creativity* which is very much required in knowledge based work such as software development. Client participation and involvement are very much needed for the success of offshore software projects (Rai et al., 2009). According to Westner (2009), trust between client and service provider influences the knowledge transfer which in turn impacts the offshore project success.

According to Gengler (2003), the success factors for software exports include national vision and strategy, international linkages and trust, project management, English language skills, and factors such as people, technology, research and development and finance. Westerveld (2003) has identified the need for linkage between project success criteria and critical success factors. He has given a project excellence model with critical success factors such as policy and strategy, stakeholder management, leadership and team, contracting, resources, and

project management factors such as schedule, organization, quality, budget, risks and project information.

Sangwan et al. (2006) based on literature review have identified five critical success factors for global software projects. They are reduce ambiguity, facilitate coordination, maximize stability, balance between flexibility and rigidity; and understand dependencies. According to Mechitov (2008), the success factors for Russian offshore software industry include cultural and political environment, local business

climate, security and privacy. Schott (2011) stressed that the knowledge transfer is crucial for project success in offshore software projects. Organizational factors such as trust, risk, power relations and knowledge factors such as ambiguity, complexity and tacitness impact the knowledge transfer between organizations (Schott, 2011). According to Avison and Torkezadeh (2009), offshore information systems success depends on communication and cultural understanding.

Table 2: Identified Success factors of offshore software projects

CSF Category	Success Factor	References	Citations in Literature
1. Cultural Factors (6 factors)	Cultural Understanding	Jennex and Adalakun (2003), Amberg and Wiener (2006), Ranganathan and Balaji (2007), Huang and Trauth (2007), Adalakun (2008), Raisinghani et al. (2008); Avison and Torkezadeh (2009), Patel et al. (2009)	8
	Management of Cultural Differences	Mathrani et al. (2005), Ranganathan and Balaji (2007), Huang and Trauth (2007), Eberlein (2008), Witthaus(2008), Patel et al. (2009)	6
	Cultural Intelligence	Amberg and Wiener (2006), Huang and Trauth (2007), Philip et al. (2010), Capatina (2011)	4
	Shared Values and Norms	Huang and Trauth (2007), Ranganathan and Balaji (2007), Rai et al. (2009)	3
	Offshore Leader Cultural awareness	Eberlein (2008), Adalakun (2008)	2
	Behaviors and attitudes	Huang and Trauth (2007), Eberlein (2008),	2
Sub-Total			25
2. Language Factors (4 factors)	Overcome language barriers	Carmel (2003), Ranganathan and Balaji (2007), Eberlein (2008), DeHondt and Knapp (2008)	4
	Language skills	Jennex and Adalakun (2003), Adalakun (2008)	2
	Common Language	Philip et al. (2010)	1
	Complexity of Language	Huang and Trauth (2007)	1
Sub-Total			8
3. Time Zone Factors (3 factors)	Managing Different time zones	Jennex and Adalakun (2003), Witthaus(2008), Adalakun (2008)	3
	Time zone multiplicities	Ranganathan and Balaji (2007)	1
	Time differences	Patel et al. (2009)	1
Sub-Total			5
4. Organizational Factors (both Client & Vendor Factors) (14 factors)	Trust	Jennex and Adalakun (2003), Mathrani et al. (2005), Kolding and Kroa(2007), Ranganathan and Balaji (2007), Adalakun (2008), Witthaus(2008), Rai et al. (2009), Westner (2009), Westner and Strahinger (2010)	9

CSF Category	Success Factor	References	Citations in Literature
4. Organizational Factors (both Client & Vendor Factors) (14 factors)	Relationship between Client and Vendor	Dyrhaug et al. (2003), Mathrani et al. (2005), DeHondt and Knapp (2008), Eberlein (2008), Raisinghani et al. (2008), Rai et al. (2009), Avison and Torkzadeh (2009), Gold (Undated, 1a)	8
	Contract Type	Jennex and Adalakun (2003), Mathrani et al. (2005), Amberg and Wiener (2006), Ranganathan and Balaji (2007), DeHondt and Knapp (2008), Adalakun (2008), Raisinghani et al. (2008), Avison and Torkzadeh (2009)	8
	Off-shoring expertise	Jennex and Adalakun (2003), Amberg and Wiener (2006), DeHondt and Knapp (2008), Adalakun (2008), Westner (2009), Westner and Strahringer (2010)	6
	Intellectual property rights	Jennex and Adalakun (2003), Ranganathan and Balaji (2007), Adalakun (2008), Avison and Torkzadeh (2009), Nassimbeni et al.(2010)	5
	Costs	Jennex and Adalakun (2003), Adalakun (2008), Raisinghani et al. (2008), Gold (Undated, 1a)	4
	Client Participation	Amberg and Wiener (2006), DeHondt and Knapp (2008), Rai et al. (2009)	3
	Business Processes	Jennex and Adalakun (2003), Adalakun (2008), Avison and Torkzadeh (2009)	3
	Liaison Quality	Mathrani et al. (2005), Amberg and Wiener (2006), Westner (2009)	3
	Offshore Senior management commitment	Dyrhaug et al. (2003), Gold (Undated, 1a)	2
	Payment Processes	Jennex and Adalakun (2003), Adalakun (2008)	2
	Organizational structures	Amberg and Wiener (2006), Eberlein (2008),	2
	Onsite/offshore Travels	Jennex and Adalakun (2003), Adalakun (2008)	2
	Vendor financial stability	Amberg and Wiener (2006)	1
Sub-Total			58
5. Environmental Factors (9 factors)	Legal Environment	Jennex and Adalakun (2003), Amberg and Wiener (2006), Ranganathan and Balaji (2007), Adalakun (2008), Raisinghani et al. (2008)	5
	Telecom Infrastructure	Jennex and Adalakun (2003), Prikladnicki et al.(2004), Adalakun (2008)	3
	Political environment	Amberg and Wiener (2006), Ranganathan and Balaji (2007), Avison and Torkzadeh (2009)	3
	Physical Security	Avison and Torkzadeh (2009), Nassimbeni et al.(2010)	2
	Currency Exchange Rates	Jennex and Adalakun (2003), Adalakun (2008)	2

CSF Category	Success Factor	References	Citations in Literature
5. Environmental Factors (9 factors)	Visa Regulations	Jennex and Adalakun (2003), Adalakun (2008)	2
	Customs and Tax Laws	Jennex and Adalakun (2003), Adalakun (2008)	2
	Economic Environment	Dyrhaug et al. (2003)	1
	International Linkages	Carmel (2003)	1
Sub-Total			21
6. Communication Factors (4 factors)	Efficient Communication	Dyrhaug et al. (2003), Prikladnicki et al.(2004), Mathrani et al. (2005), Amberg and Wiener (2006), Kolding and Kroa(2007), Eberlein (2008), Witthaus(2008), Avison and Torkzadeh (2009), Gold (Undated, 1a)	9
	Communication technologies	Carmel (2003), Ranganathan and Balaji (2007), Witthaus(2008)	3
	Communication Protocols	Witthaus(2008)	1
	Communication styles	Huang and Trauth (2007)	1
Sub-Total			14
7. Technology Transfer Factors (5 factors)	Technical Skills	Amberg and Wiener (2006), Adalakun (2008)	2
	Data Privacy and Security	Ranganathan and Balaji (2007), Nassimbeni et al.(2010)	2
	Training	Prikladnicki et al.(2004), Mathrani et al. (2005)	2
	Network Security	Avison and Torkzadeh (2009), Gold (Undated, 1a)	2
	Documentation	Mathrani et al. (2005)	1
Sub-Total			9
8. Knowledge Transfer Factors (6 factors)	Efficient knowledge transfer	Ranganathan and Balaji (2007), Kolding and Kroa (2007), DeHondt and Knapp (2008), Westner (2009), Patel et al. (2009), Westner and Strahringer (2010), Philip et al. (2010), Gold (Undated, 1a)	8
	Domain knowledge	Mathrani et al. (2005), Westner and Strahringer (2008), Philip et al. (2010)	3
	Time for Knowledge Transfer	Kolding and Kroa (2007)	1
	Absorptive capacity	Ganesh and Moitra (2004)	1
	Knowledge Management	Ranganathan and Balaji (2007)	1
	Knowledge Protection	Nassimbeni et al.(2010)	1
Sub-Total			15
9. Project Factors (16 factors)	Project Planning/ Management	Jennex and Adalakun (2003), Prikladnicki et al.(2004), Mathrani et al. (2005), Adalakun (2008), Avison and Torkzadeh (2009)	5
	Risk Sharing/Management	Dyrhaug et al. (2003), Raisinghani et al. (2008); Rai et al. (2009), Avison and Torkzadeh (2009), Gold (Undated, 1a)	5
	Requirements Uncertainty	Dyrhaug et al. (2003), Mathrani et al. (2005), Amberg and Wiener (2006), Rai et al. (2009)	4

CSF Category	Success Factor	References	Citations in Literature
9. Project Factors (16 factors)	Development Process	Prikladnicki et al.(2004), Amberg and Wiener (2006), Westner (2009)	3
	Quality	Dyrhaug et al. (2003), Mathrani et al. (2005), Westner and Strahringer (2010)	3
	Project Goal	Amberg and Wiener (2006), Witthaus(2008)	2
	PM Methodology/Standards	Amberg and Wiener (2006), Eberlein (2008),	2
	Project Suitability	Westner (2009), Westner and Strahringer (2010)	2
	Project Understanding	Eberlein (2008)	1
	Project Complexity	Rai et al. (2009)	1
	Project Size	Rai et al. (2009)	1
	Project Duration	Rai et al. (2009)	1
	Attrition Rate	Mathrani et al. (2005)	1
	Test Environment	Mathrani et al. (2005)	1
	Release Management	Mathrani et al. (2005)	1
Configuration Management	Mathrani et al. (2005)	1	
Sub-Total			34
10. Team Factors (8 factors)	Team Competencies	Jennex and Adalakun (2003), Amberg and Wiener (2006), DeHondt and Knapp (2008)	3
	Change Management	Dyrhaug et al. (2003), Amberg and Wiener (2006), Ranganathan and Balaji (2007)	3
	Team cooperation	Prikladnicki et al.(2004), Ranganathan and Balaji (2007)	2
	Team Leader Competencies & Experience	Rai et al. (2009)	1
	Conflict Management	Ranganathan and Balaji (2007)	1
	Offshore Team Climate	Mathrani et al. (2005)	1
	Team Size		0
Team cohesion		0	
Sub-Total			11

Based on literature review, total of 75 factors are considered as success factors for offshore software projects. Each of these factors comes under specific CSF category based on its meaning and applicability. The identified success factor, CSF category, references and the number of citations of that specific factor in considered literature are tabulated in Table 2. For the purpose of prioritizing the CSFs categories sub totals of number of citations of all factors come under each CSF category are also calculated.

One major finding of this current research is, the most important factor for project success, that is, the *team size* was not identified as CSFs in any of the earlier studies in the literature on offshore software projects. Also the factor *team cohesion* was not highlighted in earlier offshore team studies.

8 Final CSFs for offshore software projects

The critical success factors affecting the offshore project success will be prioritized and classified. The top priority CSFs will be found for offshore providers so that the software service providers can concentrate on them in their organizational development activities to increase the project success rate.

The critical success factors (20 factors) are identified from top two factors from each CSF category for offshore software projects which were frequently cited in the literature (Table 3).

Based on the number of citations, the top most 6 (six) critical success factors for offshore software projects in

Table 3: Critical Success Factors for Offshore Software Projects

Sl. No.	CSF Category	Critical Success Factor
1.	Cultural Factors	Cultural Understanding
2.		Management of Cultural Differences
3.	Language Factors	Overcome language barriers
4.		Language skills
5.	Time Zone Factors	Managing Different time zones
6.		Time zone multiplicities
7.	Organizational Factors	Trust
8.		Relationship between Client and Vendor
9.	Environmental Factors	Legal Environment
10.		Telecom Infrastructure
11.	Communication Factors	Efficient Communication
12.		Communication technologies
13.	Technology Transfer Factors	Technical Skills
14.		Data Privacy and Security
15.	Knowledge Transfer Factors	Efficient knowledge transfer
16.		Domain knowledge
17.	Project Factors	Project Planning/Management
18.		Risk Sharing/Management
19.	Team Factors	Team Competencies
20.		Change Management

Table 4: Top Most Critical Success Factors for Offshore Software Projects

Sl. No.	Most Critical Success Factor	Number of Citations in Literature
1.	Trust	9
2.	Efficient Communication	9
3.	Cultural Understanding	8
4.	Relationship between Client and Vendor	8
5.	Contract Type	8
6.	Efficient knowledge transfer	8

decreasing order of importance irrespective of CSF category are as shown in Table 4.

This indicates that the *trust* between client and vendor is more important than *technology transfer*, *costs* or *payment processes*. Similarly, *efficient communication*, *cultural understanding*, *relationship between client and vendor*, *contract type* and *efficient knowledge transfer* are most important CSFs for offshore software projects.

Trust is also identified as most CSF by Jennex and Adalakun (2003). *Contracting* is also identified as CSF in another study done by Westerveld (2003). The factors *relationship between client and vendor* and the *cultural understanding* are also identified as CSFs for offshore software projects in a study done by Raisinghani et al. (2008). *Efficient*

knowledge transfer, *cultural understanding* and *effective communication* (Prikladnicki et al., 2004) are also identified as CSFs in Remus and Wiener (2009).

The current research findings are in sync with the findings of an empirical study done by Rai et al. (2009). They have also identified information exchange, trust, cultural differences and relationship between client and vendor as CSFs for offshore software projects. The objective of current research has been achieved by finding the most CSFs for offshore software projects.

CSF Categories Prioritization

Similarly the most important CSF categories identified based on their sum of frequency of factor citations (sub totals)

specific to each category for offshore software projects are organizational factors (both client and vendor) (citations: 58), project factors (citations: 34), cultural factors (citations: 25), environmental factors (citations: 21), knowledge transfer factors (citations: 15), communication factors (citations: 14), team factors (citations: 11), technology transfer factors (citations: 9), language factors (citations: 8), and time zone factors (citations: 5). These findings indicate that for the success of offshore projects organizational, project and cultural factors are very much important and the least important are the time zone factors. This indicates that in the past as well, time zone differences were not barriers for the success of offshore software projects. The software engineers across the globe understand these time zone differences and they are not a constraint for them while working on offshore projects. They are least important for them. That is the reason time zone differences became an advantage for the global IT industry and they are following the sun in their project work.

9 Further Research

Limitations of Current Research

Current research has considered the cultural aspects, however the demographic variables of team members, project managers and customers such as education, age, gender, experience, etc were not considered in the current study. Considering these variables can give some new dimensions and research implications. Research on offshore software projects is very niche area in research because there are very limited empirical studies available in this area. Literature on empirical studies of offshore software projects is very limited.

Further Research Scope

Based on the identified most CSFs, hypotheses relating to project success can be drawn. The same can be proved using empirical study. This can be the further extension of the current research. Also using the 20 CSFs as an instrument, data can be collected and further CSFs can be narrowed down based on empirical study on offshore software projects. Similar research can be done to different projects in different industries because off-shoring is done in many industries such as manufacturing, engineering, and automobiles. The offshoring was started in other industries before the software industry. Further research can be done based on the impact of offshore project leader and client manager, their skills, behavior and competencies and their relationship to offshore software project success.

Implications for Research Community

The current research is applicable to research community in many ways. The factors such as *contract type* has been identified as most CSFs for offshore software projects. In this which type of contracts make the offshore projects success can be further researched. That is, the relationship between different contract types and project success can be researched. The CSFs given in this current study have considered the prominent studies in the area. Hence, the CSFs identified in current study can be used for further research on offshore software

projects. The researchers can extend this study further in the above mentioned directions.

Implications for Industry

The CSFs identified in this study are very much applicable to the software project managers both offshore leaders and customer managers. As there is no single factor which drives to the project success, the project managers have to concentrate on the combination of these CSFs and increase the probability of project success. As the current research emphasizes *trust* between offshore team and customer has to be established for making project success; followed by the efficient communication before any other factor.

10 Conclusion

To succeed in the global offshore market, offshore providers have to develop practices and models which are rare, valuable and difficult to copy (Carmel, 2003). It is best practice to have *exit strategies* as well while offshoring projects and products. Critical success factors are matter of senior management. They are to be continuously monitored and effectively managed (Dyrhaug et al., 2003) for offshore project success. Basically, CSFs for projects vary from industry to industry and country to country. Hence, similar research can be customized to different industries in different countries.

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