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Reasons for Success and Failure in Offshore Software Development Projects

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REASONS FOR SUCCESS AND FAILURE IN OFFSHORE SOFTWARE DEVELOPMENT PROJECTS

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Abstract

This paper describes an in depth analysis of successful and unsuccessful offshore custom software development (CSD) projects. Offshore projects tend to be unsuccessful, because physical, time, cultural, organizational, and stakeholder distances negatively influence communication and knowledge exchange between onshore and offshore project team members. The success rate of 19 offshore CSD projects was characterized with regard to scope, quality, time, and costs, by interviewing onshore and offshore project managers. Unsuccessful projects had a complex organization and had team members who did not work together in previous projects. All reasons for success and failure were categorized and compared. A characteristic that successful projects had in common was the availability of informal mutual adjustment, which means facilitating the informal communication between the team members in the right way. A major characteristic that unsuccessful projects had in common was improper planning, which has a large influence on the team results in an offshore CSD project. The implementation of standards was neither mentioned by the successful projects as a major reason for success, nor by the unsuccessful projects as a major reason for failure. The paper advises that in order to be successful, a project manager of a new offshore CSD project should not spend too much attention to standards, but to planning and informal mutual adjustment.

Keywords: Custom software development, Offshore project, Project coordination, Project success.

1 INTRODUCTION

Offshoring information technology (IT) services continue to grow with double digit figures, despite an estimated 50% failure rate (McCue, 2005). For custom software development (CSD) projects with substantial offshore components, this figure is, unfortunately, not lower. The sustaining importance of CSD projects and the tendency to offshore them justify a study into the factors influencing the success of these type of projects. This paper describes an account of a research that is done into this matter.

Companies decide to offshore custom software development (CSD) projects or parts thereof to low wage countries in order to cut the costs, enter a new labor pool, enter new markets, increase the quality of service, or reduce the time to market (Ravichandran & Ahmed, 1993; Krishna, Sahay & Walsham, 2004; Aspray, Mayadas & Vardi, 2006; Willcocks & Lacity, 2006).

Unfortunately, most of these goals are reached partly or not at all: more overhead causes higher costs (Kuni & Bhushan, 2006), labor forces are as quickly lost as acquired (Farrell, 2006), new entrants from the offshore countries increase competition (Narayan, 2006), quality is not as high as intended (Conchuir, Holmstrom, Agerfalk & Fitzgerald, 2006), and projects take more time than was expected (Herbsleb, Mockus, Finholt & Grinter, 2001). This development raises the question *which coordination measures can be considered as success factors or failure factors in offshore CSD projects.*

From a business perspective, an answer to this question would help IT service providers and other companies to set up efficient cooperation with colleagues in another country. It would help IT service providers to benefit from an improved offshore image that is caused by more successfully delivered projects. And it would help customers to reach the desired goals.

From a scientific point of view, in-depth qualitative research about the influence of offshore locations on collaboration in teams contributes to a better understanding of the organization and management of offshore IT projects (Damian & Moitra, 2006).

In order to answer the main research question, the scope of this research is set to CSD projects, because these are offshored most often (Gartner, 2005). In this research, all offshore CSD projects were in scope, as long as they comprised an onshore front-office team and an offshore back-office team. At the start of this research, the following sub-questions were defined:

1. When are offshore CSD projects successful?
2. Why are offshore CSD projects often less successful?
3. What are common characteristics of successful and unsuccessful offshore CSD projects?

The answers on the first two questions were found by researching scientific literature, and are described in next section. The third question was answered by analyzing and comparing 19 offshore CSD projects that varied in size, duration, type of customer, complexity, and other characteristics. By interviewing both offshore and onshore project managers, customers, and project members, the successfulness of the projects was determined. The interviews delivered many reasons for success or failure, which were compared with the successfulness of the projects. The research method, results, conclusions, and points for further research are described in the rest of this paper.

2 SUCCESS IN OFFSHORE CSD PROJECTS

According to Carmel (1999), Sakthivel (2005), and Layman, Williams, Damian, and Bures (2006), offshore software development means that the software development team is dispersed across national boundaries. Maznevski and Chudoba (2000) call such a team a ‘global virtual team’. It has the following characteristics: the people are identified as members of the team, all members are

responsible for the end product, the members communicate with each other, and the members are located in different countries.

Jarvenpaa and Leidner (1999) do not mention the different countries, but they define global virtual teams as being spread across time, space and culture. When some CSD team members are located at the east coast of the USA, and other team members are located at the west coast, this can be seen as offshoring in the same country across different time zones (Holmstrom et al., 2006). When a couple of team members are located in The Netherlands and others in South Africa, this can be seen as offshoring in different countries in the same time zone. This paper therefore defines offshore software development as the development of software in a team where people are physically located in different countries or different time zones.

Besides time, space, and cultural distances as were mentioned above, offshore teams also face organizational distances and an increased amount of stakeholders with their own goals (Carmel & Agarwal, 2001; Prikladnicki et al., 2003; Gumm, 2006). Summarizing, the following types of distance are recognized in this research: physical, time, cultural, organizational, and stakeholder distances. Organizational distances mean the amount of different organization cultures involved, and stakeholder distances mean the amount of people involved with different goals in mind.

2.1 When are offshore CSD projects successful?

Jiang, Klein, and Discenza (2002) researched literature in the 20th century about project success. In a large part of that century, costs, time and savings were the most important success determinants. Agarwal and Rathod (2006) state that both the customer (who requests software) and software development teams agree, that delivering the required product is the most important goal. If this goal is not met, the project is a failure. Another important aspect of success that they mention is quality. Procaccino, Verner, Overmyer, and Darter (2002) agree that if quality is not reached, the customer satisfaction will be very low, and the project is considered unsuccessful. The conclusion is that a successful CSD project delivers software that meets the requirements, has at least the expected quality, is completed on time and does not exceed its budgeted costs.

Agarwal and Rathod (2006) state that a lot of research is done on project successes, but almost no research is done in project failures. Someone who did analyze failed software development projects was Linberg (1999). He defines project failure as a project that is cancelled or that does not meet budget, delivery objectives and/or business objectives. Delivery objectives and business objectives include scope, quality and time. Therefore, an unsuccessful CSD project can be defined as being cancelled, or failing on one of the four *success aspects*: delivering software that does not meet the requirements, not meeting the expected quality, not being completed on time, or exceeding its total budgeted costs:

- A **de-scoped project** is a project where the final result is *less* than the result that was expected by the customer: $S_r / S_p < 1$, where S_r is the realized scope and S_p is the expected scope.
- A **below-quality project** is a project where the final quality is *below* the expected quality. This can be formulated as: $Q_r / Q_p < 1$, where Q_r is the realized quality and Q_p is the expected quality.
- An **out-of-time project** is a project that takes *more* time than was planned. This can be formulated as: $T_p / T_r < 1$, where T_r is the real time needed and T_p is the planned time.
- An **out-of-budget project** is a project that costs *more* than was budgeted. This can be formulated as: $C_p / C_r < 1$, where C_r are the real costs and T_p are the planned costs.

Most CSD projects have different sub-goals. A project should for instance be completed on time, in the first place. In such a case, out-of-budget should be less important than out-of-time. An overall successful CSD project can therefore be formulated as (where W_X is the weight factor of X):

$$\frac{1}{W_S + W_Q + W_T + W_C} * \left(\frac{S_r}{S_p} * W_S + \frac{Q_r}{Q_p} * W_Q + \frac{T_p}{T_r} * W_T + \frac{C_p}{C_r} * W_C \right) \geq 1$$

The sum of all success aspects must be higher or equal to one. If it is below one, a project is called unsuccessful. Section 3.2 elaborates on this. As will become clear in section 3, this equation does not give an answer on the research question, but helps to operationalize the success of the researched projects.

2.2 Why are offshore CSD projects often less successful?

Linberg (1999) states that developing offshore adds new cultural characteristics to the development team. The increased diversity can lead to a stronger team and a better quality. Unfortunately, it often leads to poor decision quality, poor productivity and poor relationships (Cramton, 2001). One major cause of this result and the not-reached goals that were mentioned in the introduction is poor communication (Chan & Chung, 2004; Paasivaara & Lassenius, 2006; Layman et al., 2006).

Project communication is the exchange of information about the task, resources and organizational issues (Gowda & Polzella, 2006). Carmel and Agarwal (2001) and Aranda, Vizcaíno, Cechich, and Piattini (2006) stress that the exchanged information in successful communication requires to be complete and unambiguous. This is harder when a project team faces some of the distances that were mentioned at the beginning of this section, i.e. physical, time, cultural, organizational, and stakeholder distances. These distances influence project communication negatively, and therefore also influence the knowledge exchange in a project (Cramton, 2001). Sole and Edmondsen (2002) stress that poor knowledge exchange also negatively influences communication. In the end, this process influences the project success negatively (Egan, Tremaine, Fjermestad, Milewski & O'Sullivan, 2006).

2.3 How can offshore CSD projects be made successful?

According to Aranda et al. (2006), not only communication is challenged in an offshore situation, but also the control and coordination. Carmel and Agarwal (2001) and Egan et al. (2006) agree, by mentioning that coordination is being influenced by distances and influences project success.

Herbsleb and Grinter (1999) state, that coordination is essential to align all efforts and knowledge in a project. Project coordination should be adapted, in order to get the quality of knowledge exchange on the level as it should be. This turns out to be one of the main sources why offshore projects fail: project management is not adapting in the right way to the new offshore situation that is different from a distributed situation in the home country (Nicholson & Sahay, 2004). Chan and Chung (2004) state, that both process and project management mechanisms have to be analyzed.

Based on Kraut and Streeter (1995), Sabherwal (2003), and Zhang, Tremaine, Fjermestad, Milewski, and O'Sullivan (2006), five types of coordination categories have been defined:

- **Standards:** all methodologies, rules, dictionaries, procedures, and other standards.
- **Planning:** all schedules, milestones and other plans.
- **Formal mutual adjustment:** this type of measures coordinates formal project communication, such as reporting lines and formal review procedures.
- **Informal mutual adjustment:** this type of measures coordinates informal project communication, such as having lunch together, introducing an onsite coordinator and installing instant messaging.
- **Team selection:** this influences technical competency, motivation, and teamwork skills.

Carmel and Agarwal (2001) state, that in order to overcome cooperation problems in offshore teams, temporal distance and cultural distances have to be reduced. This can be done by working at night or selecting countries in the same time-zone to offshore, and by facilitating cultural exchanges. Organizational distances and stakeholder distances can also be reduced. Herbsleb and Grinter (1999) propose the introduction of team members ('boundary spanners') on both sides, who have more experience with the culture, stakeholders, organization and time on the other location. By choosing a

set of coordination measures from the previously mentioned categories, the communication, knowledge exchange, and in the end the success of a project can be influenced.

3 RESEARCH METHOD

The literature research showed that the above mentioned coordination categories influence communication and knowledge exchange. In the end, this influences the performance of a project on scope, quality, duration, and costs. By applying certain coordination measures, the distances, communication, and performance can be influenced.

Multiple distances that influence projects probably require multiple coordination strategies. The proposition is therefore that measures of all five described coordination measure categories should be present in a project, in order to be successful on scope, quality, time, and costs.

In order to answer the last sub-question from section 1, 19 completed offshore CSD projects were selected. All 19 onshore projects managers, 15 offshore project managers, and 5 customers were asked in one-hour semi-structured interviews how successful the projects were with regard to scope, quality, duration, and costs. They were also asked to give at least one and at most five reasons why their project was successful on some aspects and why their project was unsuccessful on other aspects. The answered coordination measures were categorized according to the coordination measure categories that were mentioned in previous section, in order to see which coordination measures were mentioned most often as a cause for success or failure. The categorization was done by using examples that were formulated by Kraut and Streeter (1995).

3.1 Case details

The projects had at least one team member onshore and at least one team member offshore. The offshore team members of one project were located in Malaysia, the members of another project in Romania, and all other offshore people were located in India. All onshore team members were located in The Netherlands. The set of projects varied in team size (5 – 300 team members), amount of stakeholders (2 – more than 6), project duration (1 month – 5 years), type of customer (government, product software companies, banks, insurance companies, professional services, industry, telecommunications, retail), programming language (.NET, Java, Coolgen), total costs (30.000 Euro – 60.000.000 Euro), and type of contract (fixed price, time & materials, and combinations). This variation was chosen in order to be able to compare different characteristics and get as much results as were possible.

Fourteen projects were executed by two separate business units of the an IT services company: six in one business unit, eight in another business unit. In order to get data from offshore CSD projects that were not executed by this IT services company, five extra projects were selected, which were executed by other companies. The names of all companies are known to the authors, but will not be mentioned in this paper.

3.2 Measuring performance

In section 2.1 a formula has been presented to determine the success of a project. Possible indicators to measure the variables in the formula are: function points for scope, error rate for quality, deadlines for time, and money paid by a customer for costs. Unfortunately, all of these are hard to measure in reality: only half of the projects used function points, not all errors were registered and communicated, and deadlines were often changed formally or informally. Changes by customers often caused projects to recalculate the costs and time, based on the current status. This made it also impossible to choose which planning or budget should be used for the formula.

Therefore, the project managers and the customers were asked to indicate how successful the projects were with regard to each success aspect, on a scale from 1 to 5 (1 was very unsuccessful, 2 was unsuccessful, 3 was neither successful nor unsuccessful, 4 was successful, and 5 was very successful). In this way, the average score that was given for scope by multiple offshore managers, onshore managers, and customers, indicates the result of $(S^r / S^p) * W^S$ in the success formula. The other average scores would indicate the successfulness of quality, time, and costs. Since the weight of each aspect is determined in the score that was given by the project managers, the overall success is the average of all success aspects, by dividing the sum by four. In this way, a successful project is formulated as:

$$\frac{1}{4} * (S + Q + T + C) > 3$$

Where S means successfulness of scope, Q of quality, T of timing, and C of costs. The average result on the left side of the formula was considered as the overall successfulness of the project. If the result was below three, at least one project manager indicated that that project was 'unsuccessful' (someone gave a score of 1 or 2). This classified the project as unsuccessful. If the result was between three and four, at least one project manager had indicated that the project was 'not a success' (someone gave a score of 1, 2, or 3). Such a project was not marked as successful, not marked as unsuccessful. If the result was four or above, the project was classified as successful.

3.3 Reliability & validity

In order to increase the reliability of the collected data, an interview protocol was prepared, based on scientific literature and introductory interviews with four project managers in The Netherlands and India. The interviews of Dutch project managers and customers were held at their own offices. This increased the reliability, since the interviewed persons felt more at ease and in control. One offshore project manager from Romania was interviewed by phone.

The Indian project managers who were not temporarily in The Netherlands were interviewed via an advanced high bandwith videoconference facility that made it possible to look each other straight into the eyes. According to Carmel (1999), high bandwidth videoconferencing has a high psychological interaction and therefore communication richness. It also helps to increase trust between both conversation partners, and therefore increases reliability of the results. During the interviews, the project managers from India did not hesitate to mention points for improvement and to indicate the (un)successfulness of the projects.

In order to increase the reliability of the research, all conversations were recorded. This data was combined with notes that were taken during the interviews, and processed into an Excel worksheet. The categorization of the reasons for success and failure was done using the categorization of coordination measures and examples that were mentioned by Kraut and Streeter (1995), Sabherwal (2003), and Zhang et al. (2006) as presented in section 2.3.

According to Yin (2003), more than one source should be used in order to get high construct validity. To reach this redundancy, project managers from both the offshore and the onshore countries were interviewed. This resulted in data triangulation with multiple data sources from different organizations and countries.

In order to check if the successfulness that was determined by the interviewed team members was valid, a short questionnaire was sent to all team members of nine projects, to ask them if their projects were successful. With a response rate of 43% of in total 212 team members, the team members of the unsuccessful projects on average agreed that their projects were not successful. The team members of the successful projects confirmed the success.

4 RESULTS & ANALYSIS

An overview of the success scores that were given to the projects is shown in table 1. This table mentions the distinct success aspects and the average success score.

Figure 1 gives a summary of all projects that were successful, unsuccessful, or in between. The figure shows that most projects were successful with regard to scope and quality, but not with regard to time and costs. In the introduction was mentioned that 50% of offshore CSD projects are successful. This percentage can also be recognized in figure 1.

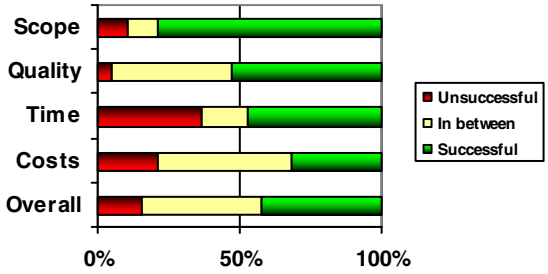

Figure 1. The amount of success on each aspect of success (N = 19)

ID	Type of company	Scope S	Quality Q	Time T	Costs C	Overall success (S+Q+T+C)/4
1	Insurance	4,0	3,5	1,5	2,5	2,9
2	Bank	2,0	3,0	2,5	2,5	2,5
3	Professional services	5,0	4,5	4,5	3,5	4,4
4	Bank	3,5	5,0	4,5	3,5	4,1
5	Insurance	4,0	4,0	2,5	3,5	3,5
6	Retail	4,0	3,3	3,3	3,3	3,5
7	Bank	4,0	4,0	4,0	3,5	3,9
8	Product software company	2,7	2,7	3,3	4,3	3,3
9	Government	5,0	4,0	2,5	4,5	4,0
10	Bank	5,0	4,0	2,0	3,0	3,5
11	Government	4,0	3,5	3,0	3,0	3,4
12	Industry	4,0	4,5	4,0	3,0	3,9
13	Government	4,3	3,0	4,7	4,0	4,0
14	Telecommunications	3,5	3,5	4,0	5,0	4,0
15	Professional services	4,0	3,0	2,0	2,0	2,8
16	Product software company	5,0	5,0	4,0	4,0	4,5
17	Insurance	5,0	3,0	2,0	2,0	3,0
18	Product software company	4,5	5,0	4,5	5,0	4,8
19	Product software company	5,0	4,0	5,0	3,0	4,3

Legend:	
Cell-color black	Unsuccessful project
Cell-color gray	Neither successful nor unsuccessful project
Cell-color white	Successful project

Table 1. Success scores of the projects that were researched

The success of the projects can be compared with general project data. This is visualized in figure 2. In an independent samples t-test, the successfulness of the projects was compared with the team size, project duration, organizational complexity, and experience of the team members.

The successfulness of complex (i.e. they did not have many stakeholders) and less complex projects differed significant ($t = 2.87$, $\alpha < 0.05$), which was also the case with the experience of the teams in previous projects ($t = 3.36$, $\alpha < 0.01$). Successful projects were characterized as being not very complex and consisting of team members that had worked together in previous projects. Unsuccessful projects were characterized as being complex and consisting of team members that did not know each other at start of the project.

The successfulness of different team sizes and project durations differed not significant, although the graphs seem to indicate the increased successfulness of smaller teams and projects that are completed within 9 months.

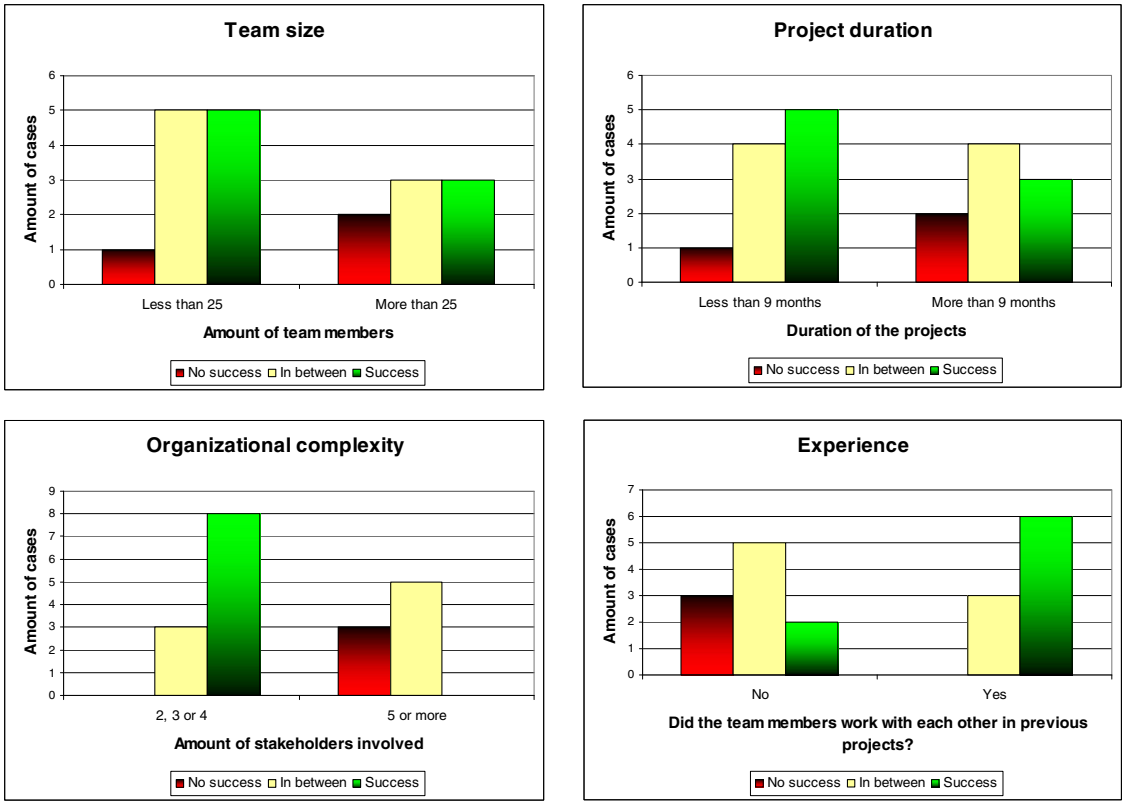

Figure 2. Some project characteristics compared to the overall success of projects.

The team members mentioned in total 73 positive and 100 negative coordination measures as causes for the result of their projects. Many negative coordination measures were the opposite of the positive ones. 'Clear responsibilities' as successful reason was for instance mentioned as 'unclear responsibilities' in the unsuccessful reasons.

Figure 3 shows which part of those arguments belonged to each coordination measure category. The left part shows reasons for success that were given by members of successful or unsuccessful teams. The right part gives reasons for failure given by all members. This figure shows for example, that problems with regard to standards were not mentioned by unsuccessful teams (the left bar in the right figure has no white part). The availability of good standards was on the other hand mentioned as a reason for some success in those unsuccessful projects (a large white part in the left bar of the left figure). This unfortunately turned out to be not the best coordination measure.

The successful projects mentioned informal mutual adjustment most often as reason for success. Standards were not mentioned at all. The unsuccessful projects did not give informal mutual adjustment as main reason: the project managers mentioned bad planning as the main cause for the failure of their projects (about 40%). They did not mention standards as reason for the negative results, too.

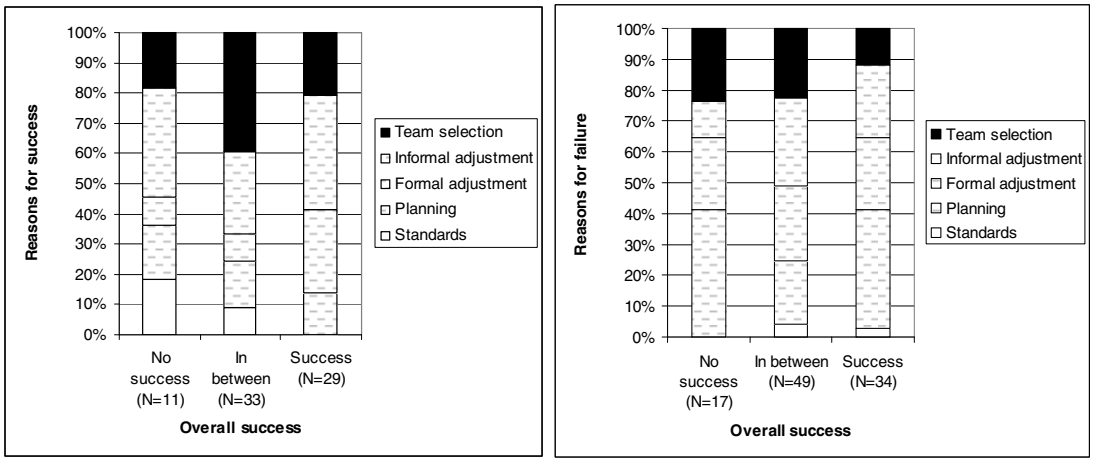

Figure 3. The coordination measures that were mentioned (N = amount of reasons).

In order to show which reasons were mentioned by the project managers, an overview of the reasons for success of the four most successful projects and the reasons for failure of all unsuccessful projects is given in table 2. This list shows that standards were not mentioned as important. The description of requirements and a proper timing of back-office involvement were important for successful planning. The specification of responsibilities and sharing of all documents were important with regard to formal mutual adjustment. Informal mutual adjustment mentioned to prevent a project setup in which creative work is done onshore and non-creative production work is done offshore. This negatively influenced the team morale. Selection of capable and experienced team members was also mentioned as influencing the success of an offshore project. A complete list of all mentioned reasons can be found in Fabriek et al. (2007).

5 DISCUSSION AND CONCLUSIONS

This research focuses on the following research question: *Which coordination measures are considered as success factors or failure factors in offshore CSD projects?*

The literature research helped to define successful CSD projects with respect to scope, quality, time, and costs. It showed that five kinds of distances negatively influence the success of offshore CSD projects.

The results showed that the offshored CSD projects were more successful with regard to scope and quality, but less successful with regard to time and costs. This leads to the conclusion, that in order to increase the success of an offshore CSD project, extra attention should be given to either planning or budgeting.

Furthermore, projects with a small amount of stakeholders involved were considered successful. They often had team members that worked with each other and with the customer before the project started. This leads to the conclusion that in order to increase the amount of successful offshore CSD projects, those projects should be offshored that have team members who already worked together before and that have a small amount of stakeholders. If a project has a completely new team and a large amount of stakeholders, it is wise to reconsider whether this project should be conducted offshore, or if the project should be conducted at all.

	Reasons for success of the 4 most successful projects:	Reasons for failure of the 3 unsuccessful projects:
Standards	None	None
Planning	• There were clear deadlines. • There was a good planning.	• There was a fixed price and a fixed date. • Due to a lot of uncertainties, planning was impossible. • The customer did not know all his requirements. • There were a lot of changes in the requirements. • Extra changes that the customer requested cost too much time. • The back-office was involved in the project very late. • The back-office started too early.
Formal mutual adjustment	• The functionalities were clearly specified. • The responsibilities of the back-office were predefined. • The back-office worked with good documentation. • Management of both countries met a couple of times.	• The use cases were in Dutch and had to be translated. • All requirements were 'thrown over the wall'. • The kickoff was onsite and not offshore. • There were visa problems which prevented traveling.
Informal mutual adjustment	• The organization was informal. • The background of the requirements was made clear to the back-office. • We used a collaboration tool. • We used an instant messaging tool.	• The front-office did not give the information that was needed. • There was not one common repository.
Team selection	• The team members were very flexible. • The team members worked very hard.	• The project manager in the front-office had not enough experience at start. • The size of the team was too large. • Team members did not give priority to the project. • People reacted late on mails and document requests.

Table 2. An overview of the reasons of success or failure mentioned by the most successful and unsuccessful projects.

The results show that informal mutual adjustment if often mentioned as something that contributes a lot to the success of projects. Team selection and formal mutual adjustment are also important. Insufficient planning was mentioned as a major cause of failure, and standards were not mentioned at all. This leads to the conclusion that planning and informal mutual adjustment need extra attention, in order to increase the success of an offshore CSD project. Formal mutual adjustment and team selection also need attention, but focusing on standards does not primarily contribute to success.

Table 2 shows how each of the coordination categories was set up successfully or unsuccessfully. These best and worst practices can help project managers to improve offshore CSD projects.

This research identified and compared 19 successful and unsuccessful offshore CSD projects. The causes of success were based on the statements of the interviewed project managers. The t-test showed that the successfulness of projects with different complexity and team experience differed significant.

The conclusions are applicable to offshore CSD projects, since these projects were the subject of research. Nevertheless, they can also be applied to onshore CSD projects, in order to increase the

chance on success. This research does therefore not conclude that the results are exclusively applicable to offshore CSD projects. They can assist offshore CSD project managers to increase the chance on success, or assist researchers in identifying the characteristics of successful and unsuccessful offshore project situations. Furthermore, this research contributed to scientific research by making a comparison of success and coordination in offshore CSD projects. It also contributes by giving a starting point for new research in the area of success measurement and in depth analyses of causes for failed of successful offshore CSD projects.

Two areas can be explored by future research. In the first place, research on a larger amount of projects can give more significant results that underpin or reject the results of this research. In the second place, a comparative research between offshore and onshore CSD projects can help to identify which coordination measures exclusively increase the chance on success of offshore CSD projects, and which measures increase the success of all CSD projects.

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References

Agarwal, N. & Rathod, U. (2006). Defining 'success' for software projects: An exploratory revelation. *International journal of project management*, 24, 358-370.

Aranda, G.N., Vizcaíno, A., Cechich, A. & Piattini, M. (2006). Technology selection to improve global collaboration. *IEEE International conference on global software engineering*, 2006.

Aspray, W., Mayadas, F. & Vardi, M.Y. (2006). *Globalization and offshoring of software. A report of the ACM job migration task force.* Association for Computing Machinery. Derived on 16 November 2006, from http://www.acm.org/globalizationreport.

Carmel, E. (1999). *Global Software Teams.* Upper Saddle River, NJ: Prentice Hall.

Carmel, E. & Agarwal, R. (2001). Tactical approaches for alleviating distance in global software development. *IEEE Software*, March/April 2001.

Chan, K.C.C. & Chung, L.M.L. (2004). Integrating process and project management for multi-site software development. *Annals of software engineering*, 14, 115-143.

Conchuir, E.O., Holmstrom, H., Agerfalk, P.J. & Fitzgerald, B. (2006). Exploring the assumed benefits of global software development. *IEEE International conference on global software engineering*, 2006.

Cramton, C.D. (2001). The mutual knowledge problem and its consequences for dispersed collaboration. *Organization science*, 21(3), 346-371.

Damian, D. & Moitra, D. (2006). Global software development: how far have we come? *IEEE Software*, September/October 2006.

Egan, R.W., Tremaine, M., Fjermestad, J., Milewski, A. & O'Sullivan, P. (2006). Cultural differences in temporal perceptions and its application to running efficient global software teams. *IEEE International conference on global software engineering*, 2006.

Fabriek, M., Brand, M. van den, Brinkkemper, S., Harmsen, F. & Helms, R. (2007). *Improving offshore communication by choosing the right coordination strategy.* Technical Report. Utrecht University.

Farrell, D. (2006). Smarter offshoring. *Harvard business review*, June 2006.

Gartner (2005). *User survey: Offshore outsourcing, Western Europe, 2004-2005.* Gartner Dataquest.

Gowda, R.G. & Polzella, D.J. (2006). Comparison of selected survey instruments for software team communication research. *IEEE International conference on global software engineering*, 2006.

Gumm, D.C. (2006). Distribution dimensions in software development projects: a taxonomy. *IEEE Software*, September/October 2006.

Herbsleb, J.D. & Grinter, R.E. (1999). Splitting the organization and integrating the code: Conway's law revisited. *Proceedings of the 21st international conference on software engineering*, 85-95.
Herbsleb, J.D., Mockus, A., Finholt, T. & Grinter, R.E. (2001). An empirical study of global software development: distance and speed. *Proceedings of the 23rd international conference on software engineering.*
Holmstrom, H., Conchuir, E.O., Agerfalk, P.J. & Fitzgerald, B. (2006). Global software development challenges: a case study on temporal, geographical and socio-cultural distance. *IEEE International conference on global software engineering*, 2006.
Jarvenpaa, S.L. & Leidner, D.E. (1999). Communication and trust in global virtual teams. *Organization science*, 10(6), 791-815.
Jiang, J.J., Klein, G. & Discenza, R. (2002). Perceptions of software success: provider and user views of system metrics. *Journal of systems and software*, 63(1), 17-27.
Kraut, R.E. & Streeter, L. (1995). Coordination in software development. *Communications of the ACM*, 38(3).
Krishna, S., Sahay, S. & Walsham, G. (2004). Managing cross-cultural issues in global software. *Communications of the ACM*, 47(4), 62-66.
Kuni, R. & Bhushan, N. (2006). IT application assessment model for global software development. *IEEE International conference on global software engineering*, 2006.
Layman, L., Williams, L., Damian, D., & Bures, H. (2006). Essential communication practices for extreme programming in a software development team. *Information and software technology*, 48, 781-794.
Linberg, K.R. (1999). Software developer perceptions about software project failure: a case study. *The journal of systems and software*, 49, 177-192.
Maznevski, M.L. & Chudoba, K.M. (2000). Bridging space over time: global virtual team dynamics and effectiveness. *Organization science*, 11(5), 473-492.
McCue, A. (2005). *Outsourcing flops blamed on tunnel vision.* Silicon.com. Published on ZDNet News, June 22.
Narayan, T. (2006). Indian offshore firms are game-changers in Europe. *Indian management*, august 2006.
Nicholson, B. & Sahay, S. (2004). Embedded knowledge and offshore software development. *Information and organization*, 14, 329-365.
Paasivaara, M. & Lassenius, C. (2006). Could global software development benefit from agile methods? *IEEE International conference on global software engineering*, 2006.
Prikladnicki, R., Audi, J.L.N. & Evaristo, R. (2003). Global software development in practice: Lessons learned. *Software process improvement and practice*, 8, pp. 267-281.
Procaccino, J.D., Verner, J.M., Overmyer, S.P. & Darter, M.E. (2002). Case study: factors for early prediction of software development success. *Information and software technology,* 44, pp. 53-62.
Ravichandran, R. & Ahmed, N.U. (1993). Offshore systems development. *Information & management*, 24, 33-40.
Sabherwal, R. (2003). The evolution of coordination in outsourced software development projects: a comparison of customer and vendor perspectives. *Information and organization*, 13, pp. 153-202.
Sakthivel, S. (2005). Virtual workgroups in offshore systems development. *Information and software technology*, 47, 305-318.
Sole, D. & Edmondson, A. (2002). Situated knowledge and learning in dispersed teams. *British journal of management*, 13, S17-S34.
Willcocks, L.P. & Lacity, M.C. (2006). *Global sourcing of business & IT services.* Palgrave Macmillan, Basingstoke/New York.
Yin, R. K. (2003). *Case study research, design and methods, 3rd ed.* Sage Publications, Newbury Park.
Zhang, S., Tremaine, M., Fjermestad, J., Milewski, A., O'Sullivan, P. (2006). Delegation in virtual team: the moderating effects of team maturity and team distance. *IEEE International conference on global software engineering*, 2006.