

Prevention of Failure Situations in Offshore Software Projects

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Abstract More and more projects are developed offshore. The main factor of success for the implementation of software systems in a global environment is project management and an organization structure that considers specific requirements of an offshore project execution. In this paper we present a classification of failure situations and criteria to identify those problem situations at an early stage. Strategies and options are provided to prevent offshore software projects from a complete failure. Finally specific milestones for checking the quality of the project management and organization structure are defined for including them as standard activities in different stages of the project plans of offshore software projects.

1 Introduction

In offshore software projects failure situations can occur as in every other conventional software project [2]. The reasons for failure situations in offshore software projects can be found for the most part in an insufficient management of these global projects. Software projects are characterized by a high complexity which is strengthened by the extremely fast technological change in this area. A further characteristic of software projects is the large number of changes requests during the project course. In offshore projects there are further challenges like language, cultural and temporal differences at a distributed worldwide implementation. Due to these general conditions and requirements in offshore software projects a good project management [9] is decisive, based on an early-warning system for the success or failure.

In Section 2 the common project definition is extended regarding the specific requirements of an offshore software project. Subsequently, in Section 3 the base dimensions and further factors to measure success or failure of offshore software projects are described. Based on these dimensions and factors a classification of failure situations is introduced. Section 4 describes criteria to identify problem situations in offshore software projects and how an early-warning system can be established for such a project. In Section 5 strategies and options are discussed that can be used after problem situations occur. Specific milestones for checking the

quality of the project management and organization structure are defined in Section 6. A conclusion and the plans for further work can be found in Section 7.

2 Offshore Software Project

For a classification of failure situations in offshore software projects it is necessary to have a definition of such projects. The term project which particularly also applies to software projects is defined as follows [14].

Project definition according to DIN 69 901 (German industry norm):

- Uniqueness of the conditions
- Target-setting
- Limitations (time, budget, resources)
- Separation from other projects
- Project-specific organization

A project stands out due to this definition by the uniqueness of the general conditions and requirements, which make each project to a unique intention. There are defined aims, which are to be reached by the project and delimitations like milestones or a fixed budget, which may not be exceeded [6]. Furthermore a project can clearly be separated from other projects and/or from the daily business. Each project has its own project-specific organization, i.e. an organization chart and regulations exists for the duration of the project as well as responsibilities in the context of the project.

In a software project the artifacts to be realized are software components, concepts, feasibility studies or similar results in the area of the software development. In offshore software projects exists the following additional conditions:

- The tasks of the project are distributed worldwide, i.e. there are linguistic, cultural and temporal barriers.
- There are huge differences regarding the costs of the individual project members, which must be considered during the planning of the budget.
- The project management and communication effort are substantially higher than in non-offshore projects, which must be also considered during the budget planning.

3 Classification of Failure Situations

In offshore software projects different failure situations can occur. This includes problems, which can still be corrected in order to be able to complete the project successfully up to projects that completely fail. Besides failure situations which can appear at onshore software projects particularly the offshore difficulties are taken into account.

3.1 Base Dimensions

Success or failure of a project is essentially measured in terms of the following base dimensions:

- Scope of work
- Time
- Budget

This precondition to measure success or failure of a project is that target specifications can be compared with actual values. I.e. that for these dimensions appropriate specifications must be available in form of a signed offer or another agreement, e.g. a contract. This just applies especially to offshore software projects, since here additional challenges occur. The mentioned dimensions can be defined as follows:

Scope of work: The service to be provided by the contractor must be clearly defined. This should be carried out in software projects in form of a detailed description of the functionality of the application system to be realized. The use of formal methods for the performance specification increases substantially the measurability of the results based on the target specifications. Textual descriptions provide space for interpretations which can be interpreted by customer and contractor differently due to the ambiguity of the natural language. Formal descriptions of processes, functions and data structures are approved regarding the practice. Prototypes play an important role for the understanding of the business people apart from textual and formal descriptions to get an impression from the result of the development in earlier phases of the project. If the service to be provided is not the implementation of a software component but an analysis then the required results should be defined in form of a listing of a table of contents of the document to deliver. Content of such documents can be process models for workflows to be implemented, descriptions of the user interface etc. Additional limits are the number of artifacts, for example the number of screens to be implemented. The analysis is not often done offshore because the biggest part of the analysis tasks have to be done onshore. The operation of IT systems, which is frequently provided by offshore companies, cannot be regarded as a project. But for operation scope of work, time and budget can also be defined.

Time: The planned period of time is provided in every project. In most projects a rough milestone plan is defined in the pre-phase of the project. There is at least a finish date on which the artifacts to be delivered shall be used.

Budget: The budget is provided either by costs or a number of person days with corresponding daily rates, which can differ depending upon qualifications. In offshore software projects the differences between different categories are huge, depending on the origin of the specific team member.

Only if all three dimensions are exactly determined, the project is defined in a mathematical way. This paper refers to projects in which a client assigns an offshore contractor for a service in the area of software development. For a not clearly defined project for which a comparison of plan and actual values cannot be made, for example due to missing definitions, success or failure is not determinable. According to META

Group already 80% of the US enterprises fail at the determination of the success or failure of software projects due to the fact that measurable target specifications, measuring instruments etc. are missing. I.e. failures of projects often arise based on the impression of the customer, to have not got what he had ordered, without having defined this clearly before the project has started.

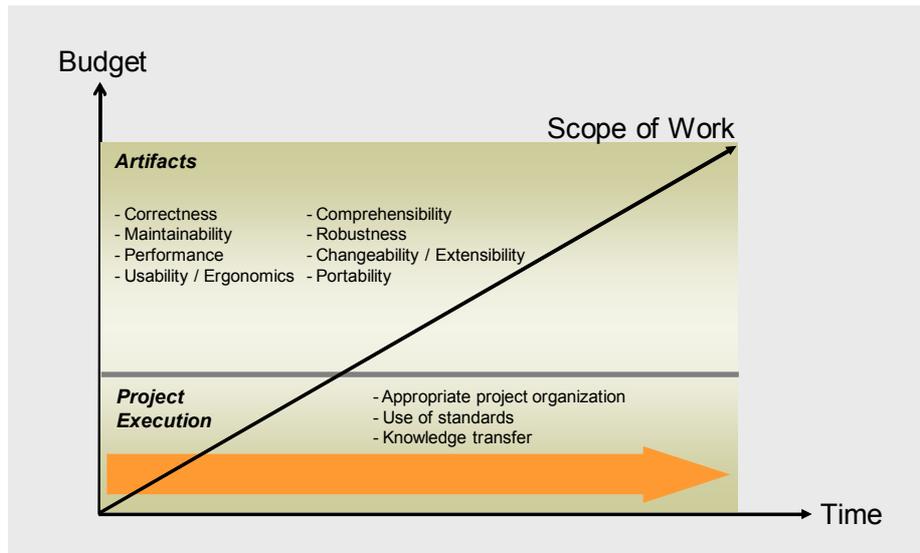


Figure 1. Limitations and quality criteria of a project

3.2 Further Factors

Besides these base dimensions mentioned above, there are some further factors, which influence the success or failure of a project. These factors can be divided in quality criteria of the delivered software [3] and the quality criteria of the offshore project execution [11].

The quality criteria for the delivered software components are:

- Correctness
- Maintainability
- Performance
- Usability / Ergonomics
- Comprehensibility
- Robustness
- Changeability / Extensibility
- Portability

The quality criteria of the offshore project execution are:

- Appropriate project organization

- Use of standards
- Knowledge transfer

These quality criteria of the delivered software components can be specified and be proofed as follows:

Correctness: Correct software must accomplish the following: Compute accurate results, operate safely and causes the system containing the software to operate safely, perform the tasks required by the system containing the software, as explained in the software specifications, achieve these goals for all inputs and recognize inputs outside its domain.

Maintainability: The maintainability of a system is difficult to proof. It depends on the structuring and documentation of the system. This can be assured and checked by the definition and the compliance of standards for comments in the source code up to standards for the configuration management of the software components.

Performance: Performance can generally be defined by the specification of the maximum response times which are still acceptable for an application system. Such general specifications, however, are not reasonable in most projects since the response times can and may differ depending on the function. For example a report, that is provided once the day and that selects huge amounts of data, may last longer than a customer search in a call centre screen. I.e. a definition of the response time on function level is necessary for the measurement of success or failure. This is however available at fewest projects.

Usability / Ergonomics: Due to subjective estimates on basis of experiences with old systems, which were replaced, projects are often classified as failure. For example users may complain about additional efforts, which arise due to the operation of a new graphical user interface in comparison with the usual, keyboard operated mainframe interface. The proof of Usability / Ergonomics can only be done checking specific application cases against predefined aims, for example that capturing a new customer is feasible in a determined time.

Comprehensibility: The comprehensibility of a system depends also on the structuring and documentation of the system. This can be assured and checked by the definition and the compliance of standards mentioned at the maintainability.

Robustness: The robustness of a system has to be proofed by specific tests.

Changeability / Extensibility: The changeability / extensibility of a system depends also on the structuring and documentation of the system. This can be assured and checked by the definition and the compliance of standards mentioned at the maintainability.

Portability: The portability of a system depends on the used technology and also on the structuring and documentation mentioned at the maintainability.

The quality criteria of the offshore project execution can be specified and be proofed as follows:

Appropriate project organization: The specific project organization must fit to the specific requirements of an offshore project considering the linguistic, cultural and temporal problems.

Use of standards: The use of standards for the software development is the main precondition to get software components that comply to quality criteria for the software components.

Knowledge transfer: Often a lack in the knowledge transfer in offshore projects [1] is identified not until the application system is taken into operation and the contractor removes the employees from a project. The success or failure depends on whether employees of the customer can independently carry out the operation and if necessary the maintenance due to the knowledge acquired in the context of the project. The quality of the documentation of the application system, both from the business and from the technical side is the precondition.

3.3 Classification

Based on the base dimensions and further factors listed before failure situations in offshore software projects can be divided into the following classifications:

(1) Failure / Collapse of the Offshore Software Project

Description: The project ends and one or several of the following situations have been occurred:

- The service to be provided has not been fulfilled.
- The defined functionality is not finished at the defined milestones.
- The budget was dramatically exceeded.

There are further nuances of a failure of an offshore project depending which situations occur in which strength. The worst case scenario occurs, if all three situations come together and there is any possibility of an agreement regarding the scope of work, time or budget.

Time of occurrence: At the end of the project.

Result: Stop of the project.

(2) Failures / Deficiencies in the Delivered Artifacts

Description: Quality lacks in the supplied artifacts occur.

Time of occurrence: During the course of the project since the first delivery of artifacts.

Result: Delay of the project, additional costs and efforts.

(3) Failures in the Offshore Project Execution

Description: Information lacks or delays due to management and organization failures in the offshore project execution occur. These problems can already be identified in the first phases of a project, before lacks at artifacts arise or a failure of the whole project occurs. The following cases of problems can be distinguished:

- Information lacks and delays due to additional translations occur. For example the specification is in German, translated to English and then sent to the Indian developers.
- Information lacks and delays due to the time shift between the locations occur.
- Information lacks and delays due to the missing Face-to-Face communication occur.
- There is no sufficient knowledge transfer between offshore contractor and customer. The customer cannot use the available results or he can only use them partially and has to order additional services from the offshore contractor.
- Positions in a project due to a different understanding of skills are wrongly assigned. If for example a software architect for a software project is recruited, in Europe an interdisciplinary acting specialist is searched, who has technical and business knowledge to define an optimal solution for the customer. In many cases the offshore contractor provides for such a requirement a pure technical specialist.

Time of the occurrence: During the whole project.

Result: Delay of the project, additional costs and efforts.

4 Criteria to Avoid Problem Situations

As in section 3 described there are problem situations in an offshore software project that can be already avoided at the beginning of a project. Other problem situations, like failures or deficiencies of the delivered artifacts, are identified late. Lacks in the offshore project management and organization can be identified at an early stage.

4.1 Criteria at the Start of an Offshore Software Project

At the start of an offshore software project the following criteria can be checked in order to avoid problem situations and minimize risks [5, 7, 12] already at the start of the project:

- Aim definitions of the project have to be available.
- Sufficient definitions of the artifacts have to be provided. To have a sufficient definition of the artifacts is in an offshore software projects much more important than in usual software projects, since there is only rarely Face-to-Face communication possible.

- Formal description methods have to be used for the definition of the artifacts to be delivered.
- A clearly defined course of project in the form of rough phases and milestones has to be provided.
- A project organization with escalation procedures and mediation instances has to be defined.
- Project regulations and formalities, for example the definition of common time slots for a world-wide implementation have to be defined.
- The organization of project and status meetings in a global environment has to be defined.
- The project reporting has to be defined.
- The change management process has to be defined.
- The acceptance methods have to be defined.
- The quality guidelines have to be defined.
- The tools, business software etc. with the respective versions to be used, have to be defined.

4.2 Criteria during an Offshore Software Project

During the complete life cycle of an offshore software project the following criteria can be checked, in order to identify or avoid problem situations in the course of a project at an early point. Problem situations can be identified by delays, additional costs or not applicable artifacts. To minimize risks and to prevent projects from a complete failure, the following criteria can be checked during the project:

- Test scenarios have to be defined.
- The delivered artifacts have to fit to the specification and to the defined quality criteria.
- Additional translations or additional costs due to ambiguous translations have to be considered in the project plan and in the budget.
- The time shift between the locations has to be considered in the project organization, the project plan and the budget.
- Additional communication overhead has to be considered.
- Additional business travels for face-to-face communication have to be considered in the project plan and in the budget.
- The knowledge transfer has to be organized in early stages and considered in the project plan and in the budget.
- Efforts at the onshore team members with the high daily rates are minimized.
- The positions in the project are assigned in consideration of a different understanding of skills in different countries.

5 Strategies and Options

If problem situations occur then different strategies and options can prevent the project from a complete failure. Based on the failure or deficiencies that arise different measures can be taken.

(1) Failure / Collapse of the Offshore Software Project

Depending on the level of failure the following options exist: If the defined scope of work is not fulfilled the problematic artifacts have to be corrected and the go-live has to be deferred. In case of a delay of milestones the go-live has to be deferred, if this is possible. When the budget is exceeded the additional costs have to be negotiated and a financial compromise has to be made. At the worst case scenario (all three situations come together) legal measures have to be taken.

(2) Failures / Deficiencies in the Delivered Artifacts

The failures/deficiencies in the artifacts have to be corrected by the offshore contractor and the causes have to be eliminated:

- Definition of quality standards (development, tests, documentation etc.)
- Controlling and monitoring of the compliance of the defined standards

(3) Failures in the Offshore Project Execution

Depending on the problem the following measures can be taken:

- The translations have to be considered in the planning of time and budget.
- Common time slots regarding the time shift have to be defined.
- A project organization with an appropriate collaboration environment (e.g. regular status meetings as video conferences) has to be established.
- Exact (formal) descriptions of requirements to compensate the missing face-to-face communication have to be provided.
- The knowledge transfer between offshore contractor and customer has to be planned at an early stage.
- The project structure has to be changed if positions are wrongly assigned.

6 Specific Milestones

This section describes milestones to prevent offshore software projects from failure. The milestones can be included in the project plans of the specific projects. There are different milestones to check state and quality of the offshore project execution regarding the different stages of a project.

	Time	1	2	3	4	5	6	7
Project Initialization								
...								
Project definition check (aims, specification, project plan, organization etc.)		■						
Execution of measures			■					
Setup offshore project infrastructure				■				
...								
Implementation								
...								
Delivery of artifacts					■			
Vitality check offshore project execution (delays, costs, quality, organization etc.)						■		
Execution of measures							■	
...								
Transition & Go-Live								
...								
Transition check (knowledge transfer)								■
Evaluation of the project and the execution								■
...								

Figure 2. Specific milestones for offshore software projects

6.1 Initialization

The initialization of an offshore software project is the most important stage to decide whether the project will be successful or not. In this stage the basic project execution and organization regulations have to be defined. The following milestones check the availability and the quality of these regulations and, if necessary, take appropriate measures to eliminate the insufficiencies:

- *Project definition check*: In the project definition check the criteria of the check list defined in Section 4.1 is proofed regarding availability and completeness.
- *Execution of measures*: As a result of the project definition check a list of measures is provided. These measures have to be executed. Subsequently the project definition check has to be done again.
- *Setup offshore infrastructure*: After a successful project definition check the offshore project infrastructure including organization structure, regulations and technical components can be established.

6.2 Implementation

The following milestones check the offshore project execution in the course of the project:

- *Delivery of artifact*: The offshore contractor delivers the (first) artifacts.
- *Vitality check offshore execution*: Already after the first delivery of artifacts a vitality check of the offshore execution can be carried out. In the vitality check the offshore project execution is proofed on the base of the check list defined in Section 4.2 regarding availability and completeness.
- *Execution of measures*: As a result of the vitality check a list of measures is provided. These measures have to be executed.

6.3 Transition & Go-Live

- *Transition check:* In the transition check besides the quality of the finally delivered artifacts the knowledge transfer is proofed. It has to be checked that the defined standards are used and that the documentation is correct and complete, i.e. it contains all information that is required to operate and maintain the provided system.
- *Evaluation of the project and the execution:* In the evaluation of the project and the project execution besides a check if the defined aims are achieved the offshore project execution has to be evaluated. Problems, proven proceedings and new ideas should be documented and considered in the next offshore project.

7 Conclusion and Further Work

This paper presents a comprehensive approach to manage and optimize offshore software projects. Based on a classification of failure situations criteria to identify (future) problem situations are defined. As a result a check list to prevent problem situations in offshore projects is provided. Strategies and options are discussed to be applied if problem situations actually occur.

Future plans include the extension of the V-Model [8, 15] regarding the additional requirements of offshore software projects. Specific templates for the management of offshore projects will be provided. Furthermore specific methods and tools to support collaborative global development [4, 10, 13] will be designed and implemented.

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