Information Systems Development Failure: A Case Study to Highlight the IS Development Complexities in Simple, Low Risk Projects in Developing Countries.

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ABSTRACT

Learning from an Information System Development Project (ISDP) failure plays a key role in the long term success of any organization desirous of continuous improvement via evaluation and monitoring of its information systems (IS) development efforts. This factor of learning from failure assumes a higher level of significance in the context of developing countries. In developing countries it is very important that the scarce resources are optimally utilized. This study reports on a seemingly simple (but only deceptively so), failed ISDP to inform the reader about the various complexities involved in information systems development projects in general and in developing countries in particular.

An existing framework from contemporary research is adopted to map the complexities found in the project under study. The research is qualitative in nature and interview approach is used for investigations. The research is of significance to a wide audience in the IS community who are interested in understanding the impact and influence of various factors on failure of an ISDP in the peculiar environment of a developing country.

Keywords: Information System Development Project, IS failure, Complexity, Developing Country.

1. INTRODUCTION

Failure of ISDP is not breaking news today, however the study of these projects reveals new factors for analysis. Historically IS projects have been characterized by high failure rate. A recent report [1] collected results of five different surveys from different years, i.e., 2001, 1997 & 1995 and concluded that:

- an IT project is more likely to be unsuccessful than successful
- about 1 out of 5 IT projects is likely to bring full satisfaction
- the larger the project the more likely the failure
- 40 % of the projects failed to achieve their business case within one year of going live

Heeks [2] conducted an investigation of e-government projects in developing countries. The results of his survey show an extremely disappointing position: 35% projects are total failures, 50% projects are partial failures, 15% projects are successes

The IS failure in developing countries poses more importance for learning and investigation of failure causes, as it not only wastes the allocated resources but also discourages further investment. The opportunity costs are certainly high in developing countries because of the more

limited availability of resources such as capital and skilled manpower. "The failures keep developing countries on the wrong side of the digital divide, turning ICTs into a technology of global inequality"[3]. For these type of reasons a failure in development of IS in developing country poses a significantly important area of study.

It is evident from literature that a substantial portion of total IS projects ends in full or partial failures. Results of some existing studies from developing countries are:

- Braa and Hedberg [4] have reported wide spread partial failure of high cost health information systems in South Africa.
- Kitiyadisai [5] has concluded that in public sector IS initiatives failure cases seem to be the norm in Thailand.
- Baark and Heeks [6] found that all donor-funded projects in China were partial failures.
- Moussa and Schware [7] concluded that almost all World Bank-funded projects in Africa were partial failures

The IS failure research is of paramount importance in developing countries where the failure rate is higher as compared to industrialized countries. In countries like Pakistan, where domestic market and domestic IS demand has traditionally been very low, ISDP failures discourage further demands and growth in IS industry. This scenario has established the need for studying ISDP in Pakistan, especially the failed ones. We believe that there are more opportunities and lessons for learning from failed IS projects than there are from the successful IS projects.

We are not aware of an existing study that has reported on the extent of failed IS projects in Pakistan. This paper is a first step to fill this gap. We have chosen one small and simple IS project to study ISDP failure in a Pakistan. We would also like to point out that a single case study can provide no basis for estimation of overall failure/success rates in Pakistan and further work needs to done in this direction. In our case study the developer is referred to as ALPHA and the client is referred to as BETA. ALPHA was one of the leading software houses in Pakistan operating as an independent business unit of a large and reputed international company. BETA was a top bracket public sector university. The ISDP was a web based portal for academic records management referred to as project GAMMA in this study.

According to McFarlan's Grid, [8] project GAMMA was a typical 'factory' type of application. It involved low technical and functionality risk, and the benefits were mostly tangible and quantifiable. At the outset the project looked simple and straightforward and no one perceived a non successful termination of project GAMMA. Yet, interestingly enough, the project is now unanimously termed as failure by the developer and the client. The project GAMMA is currently in a stage where BETA is dissatisfied with the solution and is not using it and ALPHA is asking for more time and resources to complete the project even when an extension time of twelve months has already expired after the original project completion time. Project GAMMA which was considered as simple IS development initiative now presents a complex situation. This situation provides us an interesting research setting to investigate the complexities present in failed IS projects and the deficiencies on part of the developer and the client.

2. THEORETICAL BACKGROUND

Attempts at developing information systems are not always successful. They fail due to many reasons, inadequate resources, bad planning, negligence in management etc. Even if an application is successful it carries the risk of imitation by the competitors, as a result the

application may require continuous improvement and subsequently prove very costly. Another risk is that the basis of competition in the industry might change rendering the application useless. Moreover there is always the risk of change in the characteristics of the industry, e.g., available technologies, consumer preferences, business process etc. All these factors require careful analysis.

The study of the failure of IS projects in developed and developing countries is one of the hot research areas and many authors have done their work to identify the factors that can minimize the failure rate. In some cases the [9] issues of project definition introduce problems in the very beginning. The scope of project could not be visualized by all of the stakeholders which influence the system analysts to overlook or not fully understand the requirements of different users. On the other hand the high expectations by the users about the system or project can cause a project to fail [10]. In ISDPs that support the existing business processes, the alignment of business and IT strategy goals is one of the critical success factors. Leading cause of some IS projects failure is the lack of alignment between business and IT departments in the organization [11]. Environmental problems like procurement, management continuity and optimistic estimations of benefits can also cause project failure [12]. Other factors like differences in age, education, system development experience and managerial position, can also have a profound effect on the success or failure of an ISDP [13]. Some analysis suggests that issues like constructivism and the sociology of technology also effect the success of an ISDP [14].

Usually in a particular project all the above discussed factors exist to some extent and at certain thresh hold point these factors can start creating cross effects and thus increase the project complexity by many times. It is generally agreed that that a higher level of project complexity, leads to low probability of project success. Heeks [3] has attempted to investigate if most information systems projects in developing countries succeed or fail? His research says that there is constrained evidence to address this question due to lack of literature in general and lack of evaluation resources in particular. In this paper we have used the frameworks described in [15] and [16] to first understand the various categories of failure prevalent in ISDP and to explain inter-dependencies of project stakeholders and then to identify the presence or absence of the factors that contributed to the project complexity and failure in our case study.

2.1 ISDP Failure Categories

Chris Sauer [15] has attempted to classify the failure categories. The classification is given in the following Table 1 and this classification provides a suitable framework to help us make initial diagnosis of the type of failure. Under the third column of the table we have indicated the types of failures evident in our sample case.

Table1: Classification of Failure Categories

Type	**Description**	**Presence in Sample Case**
Correspondence failure	Failure to achieve predefined objectives	Positive
Process failure	Failure to produce a system in given limits	Positive
Interaction failure	Level of use or user satisfaction failure	Positive
Terminal failure	Project terminated, can't be tolerated more	Still not terminated
Expectation failure	Inability to meet the expectations of specific stakeholder	Positive

2.2 Classification of Complexity

The complexity can be defined as an interaction of several parts which can be made operational differently and in interdependent ways [18]. The complexity of most information systems means that cost of leaving a flaw uncorrected may be significant because of consequential effects it might have on other parts of system [15].
Xia [16] classifies complexity in two major dimensions, organizational and technological, and then plots it against a third dimension called uncertainty for both the organizational and technological dimensions. As a result four classifications emerge which are depicted in Figure

Organizational vs. Technology	Structural	Dynamic
	Structural Organizational Complexity	Dynamic Organizational Complexity
	Structural IT Complexity	Dynamic IT Complexity

Structural vs. Dynamic

Figure2: Taxonomy of ISD Projects Complexity

2.3 Model of IS Project: Triangle of Dependencies

The project organization (ALPHA in this case) is defined as a group of people who at a particular point in time are occupied with the development, operation or maintenance of a given Information system (project GAMMA in this case). The IS must serve some organizational stakeholders and thereby function as a resource for the project organization in gathering support. Supporters (BETA and its employees in this case) provide support in terms of monetary resources, material resources, information etc. This triangle is depicted in Figure 1 and it is not a closed triangle. Each relationship is subject to a variety of exogenous factors which influence how it will affect the rest of the triangle. It was obvious that some resources were given to ALPHA development team by BETA management and the development of project GAMMA started. ALPHA delivered documentations and presentations on the working and status of the project to BETA at different milestones, to win the support from them by satisfying their needs.

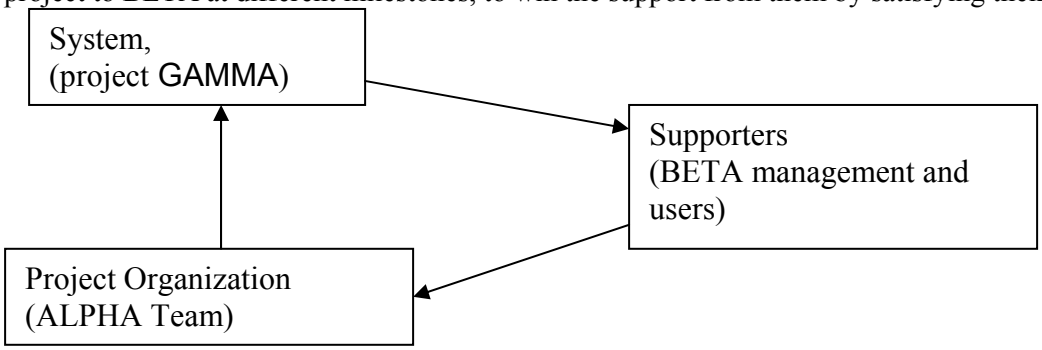

Figure 1: Triangle of Dependencies

2.4 Some Definitions: Influence, Flaw and Risk

In the triangle of dependencies each relationship is subject to a variety of influences, these influences make some aspects of the process uncontrollable but at the same time they provide scope for managing other aspects. Unbalanced influences create flaws and will produce a flawed system [15]. These alone do not constitute failures; rather lead the system to failure. The factors which highly influence a system and then tend to create flaws and make hurdles in success of IS project are termed as risks [17]. The factors involved in creating imperfection lead toward increasing the complexity of ISDP and subsequently decrease its probability of success.

2.5 Complexity and Failure Relationship

Application complexity is considered one of the major risk factors involved in project failure [19]. Level of complexity and time duration of project are positively associated to failure. One way to reduce the level of project risk and failure is to reduce the level of complexity [20]. British Computer Society found that the most common attribute underlying the failed projects was the high level of inherent complexity in the failed projects [21]. Thus it is obvious that to improve ISDP success rate and rate of return on investment, organizations must address the problem of complexity in ISDP and reduce it within limits [16].

Virtually every IS project will increase in complexity once it has been initiated. Sense of urgency in announcing the end date and addition of post-initiation components/ technology are two major causes of complexity for an IS system [20]. Size is also a source of increasing complexity, because to solve a bigger problem the project is decomposed in smaller components, and thus complexity of interaction between the components increases [22].

2.6. Research Methodology

In order to understand the factors which led the project GAMMA to failure we conducted several in-depth qualitative interviews. These interviews were flexible and exploratory in nature. In these interviews our later questions were adjusted according to the response of the interviewee in answering the earlier questions. Our aim was to clarify the earlier responses, to follow new lines of inquiry, and to probe for more detail. The overall interview style was unstructured and conversational, and the questions were open-ended and designed to elicit detailed, concrete information.

The persons interviewed included the ALPHA Project manager and the ALPHA technical team lead and the BETA team lead, BETA coordinator and a few users at BETA. The answers that warranted more clarification or were to some extent conflicting to the views expressed by the other side were further probed in the second round of discussions. ALPHA and BETA interviews were segregated from each other. Interview settings included individual and collective participation of the interviewees. The information collected was mapped on contemporary theoretical frameworks discussed in [15] and [16] to analyze the responses and understand the role of different factors that lead to the failure of our specific case under study. The information was then examined with the help of Taxonomy of ISDP complexities and factors of each category were identified.

3. DISCUSSION

In this section, the process of different phases of information system development is discussed

3.1 The Team from ALPHA

ALPHA had a team of skilled software engineers and the average experience of team members was three and a half years. The manager of the ALPHA team had software project management experience of six and a half years. The ALPHA team comprised of a blend of analysts, designers, coders and testers. ALPHA followed the incremental development approach for projects with time period of more than eight weeks, and hence the same approach was followed in this case.

3.2 The Team from BETA

BETA made a focal team comprising of senior faculty members from different departments led by one of Head of the Department. The focal team at BETA was mandated to collaborate with the ALPHA team. The responsibilities of the focal team were to help the ALPHA team to capturer the information about policies and procedures of the academic and administrative departments and units of BETA. Its main role was also to help ALPHA understand the processes and verify the requirements against specific processes. The focal team acted as the client representative and in the later stages also tested the portal and gave feed back to ALPHA team.

3.3 The Complete Process

At the start of the project, a preliminary set of requirements was agreed upon between the BETA focal team and the ALPHA team. A total of eleven modules were identified, out of which eight modules were deemed to be more critical than others. The technological requirements were not rigid and it was generally agreed to encourage the platform independent technologies e.g. Java and Linux. Regarding the choice of database, BETA preferred to use Oracle as it had its license. Next the ALPHA team analyzed the preliminary requirements by collecting the data and observing the business processes and procedures. Both the teams visited different academic departments and held meetings with the heads of the departments and different other employees. Same was done in the administrative units to record the data and procedures of different business processes. After analyzing the collected information and additional requirements, standard requirement specification document was developed and agreed upon.

In the meanwhile some significant changes occurred at BETA. Due to some routine and policy decisions some of the members of focal team from BETA were transferred and newly appointed persons took their place. As the people changed, the mindset also changed and the vision about the project also changed. Changes at the organizational level of BETA led to some new requirements emerging from nowhere and caused frequent changes in the old requirements.

Surprisingly ALPHA team had to face many objections on the already settled requirements, which were conveyed from the user departments and the end users themselves. The new members of the BETA focal team were not clear about the scope and objectives of the project GAMMA, and they also did not agree with the version of the requirements provided by the of former members of the BETA focal team. Due to this kind of divisive environment a huge time was lost in the advancement of project. ALPHA team was willing to work according to satisfaction of client organization and hence wanted to listen to the client's focal team members. As there was no consensus on requirements within the client organization, ALPHA decided to conduct some presentations and meetings with the representatives of all departments and focal team.

After some presentation and discussion sessions, the requirements analysis with conclusive set of requirements was presented and the software requirements specification document was once again finalized after incorporating the revised requirements.

At this stage in order to minimize the impact of organizational changes on the project, the management of BETA appointed a software engineer to lead the BETA focal team with the mandate that the newly appointed lead person will work continuously in the next phases till the completion of project GAMMA. The new lead person coordinated with the ALPHA team and helped them to complete the trial version of the project. ALPHA finalized the trial version of the project and deployed it at BETA. In April 2004 the first version of project was deployed at the BETA and testing was done by ALPHA's testers using real data.

At this stage training sessions were held by the ALPHA team members to guide the key potential users at BETA, with the objective that these people will use this portal and identify errors, bugs and changes. As per the evaluation and trial report of the project the users complained about a number of deficiencies. They reported variances in the expected and actual implementation of different functionalities. There were errors in data processing which caused the potential users at BETA to loose their interest. They also complained that the training was of very basic level and not properly designed and executed. The ALPHA team was of the opinion that people attending the training sessions were mostly used to using an older existing IS system and thus were reluctant to shift to the new system. Their association and familiarity with the older system created hesitancy and an attitude of disinterest that prevented them to appreciate and explore the full functionality of new portal.

It was observed that for some particular processes there were no standard operating procedures and different departments followed different procedures. This situation demanded flexibility in different data structures and functionalities of the GAMMA system. As an example the pattern of student registration number varied in different departments. Such anomalies caused some requirements changes even at the later phases and delayed the implementation.

At this stage the person who was hired earlier and was leading the BETA focal team through the development phase left BETA for another job. This particular development compelled BETA to restore the old structure of focal team of BETA. Now the head of the department of computer sciences was assigned the role of team lead by the client organization. The project at this stage required transferring the existing data from the old system to the new system, new data entry as well as testing the real time application behavior. The developers from ALPHA provided scripts to convert data from old system based on SQL server to new system. However, according to BETA the scripts did not work as per requirement which had to be modified time and again. BETA formed another team referred to as "Testing Analysis Team", to test the portal and the team members were provided training by ALPHA. Moreover a person was selected from each faculty as master trainer who was entrusted the task to further train the end users within his faculty. This task took another six months of time and further delayed the successful implementation.

The project started in September 2002 with the planned completion date of December 2003. A formal audit was conducted by the external auditors, engaged by ALPHA, in December 2003 who found that the delay was justified as the requirement engineering phase took much longer time as discussed above. The project took off a little in September 2004 when Head of Department of Computer Science started to lead the team to implement the project. However, the project implementation came to a standstill in December 2004 when the client organization desired deputation of full time experts by the ALPHA organization to supervise the implementation which included training of the end users to use the system and subsequently adopt it. ALPHA expressed their inability to depute an expert without charging further expenditure to BETA.

At present the status of the new portal is that it is being used as a as a passive repository of data. The new system has not been adopted by the end users and the system that earlier existed is in use at the organizational level. ALPHA has received part of the agreed payment amount and has an outstanding claim for the balance payment from BETA. Both organizations consider it a failed project. BETA considers it a failure as it has not been implemented and adopted at the organizational level. ALPHA considers it as a failed project because besides the financial loss, the product is termed unsatisfactory by the end users and has not been successfully deployed and adopted at organizational level.

The main reasons for the failure of this simple IS project can be summarized as follows:

Adaptation and modification of underlying organizational processes in such a way that they become conducive for automation is an issue deeply intertwined with project definition and has to be tackled in the very beginning. Once the processes have been reengineered only then the scope of automation project can be fully visualized by all the stakeholders. This factor was initially ignored in the project GAMMA when the first version of project requirements was specified. Halfway through the development process of project GAMMA, the inadequacy of the organizational processes of BETA in terms of their capacity to lend themselves to automation was realized.

The existing organizational processes of BETA were not fully mature. Introduction of a new organization wide IS system for records management and decision making implied a number of changes in the way things were done at BETA. Alignment of organizational processes and the IS systems was very important for successful implementation of GAMMA. The end users at BETA were not ready to adopt the changed organizational processes necessitated by the introduction of new technology.

The various complexity factors [16] and their impact on project GAMMA is summarized in Table 2 below.

4. CONCLUSION

The main aim of the GAMMA project was to implement a web portal for the academic and administrative records management of BETA. Hence system GAMMA was required to capture, store and process data for a number of departments within BETA. Each department had its own perspective regarding the policies and procedures of data and records management. Being in the same organization these processes were interlinked and processed the same data. These user units created complexity for the requirement analysis team to decide on particular set of requirement specification. On the other hand the users also did not provide sufficient support and their behavior was critical. The users from the lower management just pointed out the flaws even if they were because of flaws in the organizational processes of BETA. They did not accept the changes in business/organizational processes which were caused by the new information system. On the other hand the business processes kept on changing due to their own needs as the people were also changing in the organization. The changes in business processes caused the rapid change in information needs. At the technological dimension there were also some changes in IT architecture and software development tools which caused more complexity in managing the project on target.

One of the important objective of IS in developing countries is to bring about improvement in organizational and business processes. These improvements are not without incurring any risk as

modifications or improvements are prone to introduce complexities [3]. However this case study shows that the changes towards improvements in the processes caused by IS were not accepted by stakeholders, which in turn increased the weightage of various risk factors. On the other hand, the change in processes, due to organization itself, caused delays and led the requirements to change significantly which in the end proved fatal for the project

Complexity Factor	***Effect in this case***	***Level of Risk***
Structural organizational complexity (Structural_Org)	***Yes/ No***	
- The project manager didn't have direct control over project resources.	No	
- Users provided insufficient support.	Yes	**High**
- The project had insufficient staffing.	No	
- Project personnel did not have required knowledge/skills.	No	
- Top management offered insufficient support.	No	
Structural IT complexity (Structural_IT)		
- The project involved multiple user units.	Yes	**High**
- The project team was cross-functional.	Yes	**Medium**
- The project involved multiple software environments.	No	
- The system involved real-time data processing.	No	
- The project involved multiple technology platforms.	No	
- The project involved significant integration with other systems.	Yes	**Low**
- The project involved multiple contractors and vendors.	No	
Dynamic organizational complexity (Dynamic_Org)		
- The project caused changes in business processes.	Yes	**High**
- Users' information needs changed rapidly.	Yes	**High**
- Users' business processes changed rapidly.	Yes	**Medium**
- The project caused changes in organizational structure.	No	
- Organizational structure changed rapidly.	Yes	**Medium**
Dynamic IT complexity (Dynamic_IT)		
- IT infrastructure changed rapidly.	No	
- IT architecture changed rapidly.	Yes	**Low**
- Software development tools changed rapidly.	Yes	**Low**

Table2: Failure Categories and their impact on GAMMA

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REFERENCES

[1] IT Cortex, "Failure rate, Statistics over IT projects Failure rate". http://www.it-cortex.com/Stat_Failure_Rate.htm, Viewed April 2005.

[2] Richard Heeks, "eGovernment for Development Success and Failure Rates of eGovernment in Developing/Transitional Countries: Overview" IDPM, University of Manchester, UK, 2003 http://www.egov4dev.org/sfoverview.htm, Viewed April-2005.

[3] Richard Heeks, 2000, Development Informatics Working Paper Series, Paper No. 11, Failure, Success and Improvisation of Information Systems Projects in Developing Countries, Published by:Institute for Development Policy and Management, University of Manchester, UK.
[4] Braa, J. and C. Hedberg, 2000. Developing district-based health care information systems. In Information Flows, Local Improvisations and Work Practices, Proceedings of the IFIP WG9.4 Conference 2000, Cape Town, South Africa.
[5] Kitiyadisai, K., 2000. The implementation of IT in reengineering the Thai Revenue Department. In Information Flows, Local Improvisations and Work Practices, Proceedings of the IFIP WG9.4 Conference 2000, Cape Town, South Africa.
[6] Baark, E. and R. Heeks, 1999. Donor-funded information technology transfer projects. Information Technology for Development 8(4):185-197.
[7] Moussa, A. and R. Schware, 1992. Informatics in Africa. World Development 20(12).
[8] McFarlan, F. W. (1981) "Portfolio approach to information systems", Harvard Business Review, 59(5).
[9] Field, Tom. "When bad things happen to good projects", CIO magazine, Oct 15, 1997, Vol. 11, 2.
[10] Leicht, Michael. "Managing User Expectations." University of Missouri St. Louis e-publication. http://www.umsl.edu/~sauter/analysis/user_expectations.html, Viewed Dec-2003.
[11] Hoffman, Thomas. "Corporate Execs Try New Ways to Align IT with Business Units." Computerworld. October 27, 2003.
http://www.computerworld.com/printthis/2003/0,4814,86466,00.html, Viewed Dec-2003.
[12] Hulme, Martyn R. "Procurement Reform and MIS Project Success", Journal of Supply Chain Management, Winter 1997.
[13] James J. Jiang, Gary Stephen Klein, Roger Alan Pick, "Individual differences and system development", ACM SIGCPR Computer Personnel, Volume 17 Issue 3, July 1996.
[14] Nathalie Mitev, "Toward social constructivist understandings of IS success and failure: introducing a new computerized reservation system", Proceedings of the twenty first international conference on Information systems, December 2000.
[15] Chris Sauer, Why information systems fail: a case study approach, Alfred Waller Ltd., Publishers, Oxfordshire, UK, 1993
[16] Weidong Xia, Gwanhoo Lee, "Grasping the complexity of IS development projects", Communications of the ACM, Volume 47 Issue 5, May 2004.
[17] John Ward, "Principles of Information Systes Management" Routledge publications, 1995.
[18] Baccarini, D. The concept of project complexity: A review. Int. J. Proj. Mgmt. 14, 4 (Aug. 1996).
[19] Barki, H, Rivard, S., and Talbot, J., "Toward an assessment of software development risk," Journal of Management Information Systems, V. 10, No. 2, 1993.
[20] Murray, J. Reducing IT project complexity. Inform. Strat. 16, 3 (Spring 2000).
[21] The British Computer Society "The Challenges of Complex IT Projects" report Published by The Royal Academy of Engineering April 2003.
[22] Mohsen AlSharif, Walter P. Bond, Turky Al-Otaiby, " Assessing the complexity of software architecture", Proceedings of the 42nd annual Southeast regional conference, April 2004.