The Standish Group Report

CHAOS

"The Roman bridges of antiquity were very inefficient structures. By modern standards, they used too much stone, and as a result, far too much labour to build. Over the years we have learned to build bridges more efficiently, using fewer materials and less labour to perform the same task."

-Tom Clancy (The Sum of All Fears)

Introduction

In 1986, Alfred Spector, president of Transarc Corporation, co-authored a paper comparing bridge building to software development. The premise: Bridges are normally built on-time, on- budget, and do not fall down. On the other hand, software never comes in on-time or on-budget. In addition, it always breaks down. (Nevertheless, bridge building did not always have such a stellar record. Many bridge building projects overshot their estimates, time frames, and some even fell down.)

One of the biggest reasons bridges come in on-time, on-budget and do not fall down is because of the extreme detail of design. The design is frozen and the contractor has little flexibility in changing the specifications. However, in today's fast moving business environment, a frozen design does not accommodate changes in the business practices. Therefore a more flexible model must be used. This could be and has been used as a rationale for development failure.

But there is another difference between software failures and bridge failures, beside 3,000 years of experience. When a bridge falls down, it is investigated and a report is written on the cause of the failure. This is not so in the computer industry where failures are covered up, ignored, and/or rationalised. As a result, we keep making the same mistakes over and over again.

Consequently the focus of this latest research project at The Standish Group has been to identify:

- The scope of software project failures.
- The major factors that cause software projects to fail.
- The key ingredients that can reduce project failures.

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Failure Record

In the United States, we spend more than $250 billion each year on IT application development of approximately 175,000 projects. The average cost of a development project for a large company is $2,322,000; for a medium company, it is $1,331,000; and for a small company, it is $434,000. A great many of these projects will fail. Software development projects are in chaos, and we can no longer imitate the three monkeys -- hear no failures, see no failures, speak no failures.

The Standish Group research shows a staggering 31.1% of projects will be cancelled before they ever get completed. Further results indicate 52.7% of projects will cost 189% of their original estimates. The cost of these failures and overruns are just the tip of the proverbial iceberg. The lost opportunity costs are not measurable, but could easily be in the trillions of dollars. One just has to look to the City of Denver to realise the extent of this problem. The failure to produce reliable software to handle baggage at the new Denver airport is costing the city $1.1 million per day.

Based on this research, The Standish Group estimates that in 1995 American companies and government agencies will spend $81 billion for cancelled software projects. These same organisations will pay an additional $59 billion for software projects that will be completed, but will exceed their original time estimates. Risk is always a factor when pushing the technology envelope, but many of these projects were as mundane as a drivers license database, a new accounting package, or an order entry system.

On the success side, the average is only 16.2% for software projects that are completed on- time and on-budget. In the larger companies, the news is even worse: only 9% of their projects come in on-time and on-budget. And, even when these projects are completed, many are no more than a mere shadow of their original specification requirements. Projects completed by the largest American companies have only approximately 42% of the originally-proposed features and functions. Smaller companies do much better. A total of 78.4% of their software projects will get deployed with at least 74.2% of their original features and functions.

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This data may seem disheartening, and in fact, 48% of the IT executives in our research sample feel that there are more failures currently than just five years ago. The good news is that over 50% feel there are fewer or the same number of failures today than there were five and ten years ago.

Methodology

The survey made by The Standish Group was as thorough as possible, short of the unreachable goal of surveying every company with MIS in the country. The results are based on what we at The Standish Group define as "key findings" from our research surveys and several personal interviews. The respondents were IT executive managers. The sample included large, medium, and small companies across major industry segments, e.g., banking, securities, manufacturing, retail, wholesale, heath care, insurance, services, and local, state, and federal organisations. The total sample size was 365 respondents and represented 8,380 applications. In addition, The Standish Group conducted four focus groups and numerous personal interviews to provide qualitative context for the survey results.

For purposes of the study, projects were classified into three resolution types:

- **Resolution Type 1, or project success:** The project is completed on-time and on-budget, with all features and functions as initially specified.
- **Resolution Type 2, or project challenged:** The project is completed and operational but over-budget, over the time estimate, and offers fewer features and functions than originally specified.
- **Resolution Type 3, or project impaired:** The project is cancelled at some point during the development cycle.

Overall, the success rate was only 16.2%, while challenged projects accounted for 52.7%, and impaired (cancelled) for 31.1%.

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Failure Statistics

The Standish Group further segmented these results by large, medium and small companies. A large company is any company with greater than $500 million dollars in revenue per year, a medium company is defined as having $200 million to $500 million in yearly revenue, and a small company is from $100 million to $200 million.

The figures for failure were equally disheartening in companies of all sizes. Only 9% of projects in large companies were successful. At 16.2% and 28% respectively, medium and small companies were somewhat more successful. A whopping 61.5% of all large company projects were challenged (Resolution Type 2) compared to 46.7% for medium companies and 50.4% for small companies. The most projects, 37.1%, were impaired and subsequently cancelled (Resolution Type 3) in medium companies, compared to 29.5% in large companies and 21.6% in small companies.

Restarts

One of the major causes of both cost and time overruns is restarts. For every 100 projects that start, there are 94 restarts. This does not mean that 94 of 100 will have one restart, some projects can have several restarts. For example, the California Department of Motor Vehicles project, a failure scenario summarised later in this article, had many restarts.

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Cost Overruns

Equally telling were the results for cost overruns, time overruns, and failure of the applications to provide expected features. For combined Type 2 and Type 3 projects, almost a third experienced cost overruns of 150 to 200%. The average across all companies is 189% of the original cost estimate. The average cost overrun is 178% for large companies, 182% for medium companies, and 214% for small companies.

Cost Overruns	% of Responses
Under 20%	15.5%
21 - 50%	31.5%
51 - 100%	29.6%
101 - 200%	10.2%
201 - 400%	8.8%
Over 400%	4.4%

Time Overruns

For the same combined challenged and impaired projects, over one-third also experienced time overruns of 200 to 300%. The average overrun is 222% of the original time estimate. For large companies, the average is 230%; for medium companies, the average is 202%; and for small companies, the average is 239%.

Time Overruns	% of Responses
Under 20%	13.9%
21 - 50%	18.3%
51 - 100%	20.0%
101 - 200%	35.5%
201 - 400%	11.2%
Over 400%	1.1%

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Content Deficiencies

For challenged projects, more than a quarter were completed with only 25% to 49% of originally-specified features and functions. On average, only 61% of originally specified features and functions were available on these projects. Large companies have the worst record with only 42% of the features and functions in the end product. For medium companies, the percentage is 65%. And for small companies, the percentage is 74%.

% of Features/Functions	% of Responses
Less Than 25%	4.6%
25 - 49%	27.2%
50 - 74%	21.8%
75 - 99%	39.1%
100%	7.3%

Currently, the 365 companies have a combined 3,682 applications under development. Only 431 or 12% of these projects are on-time and on-budget.

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Success/Failure Profiles

The most important aspect of the research is discovering why projects fail. To do this, The Standish Group surveyed IT executive managers for their opinions about why projects succeed. The three major reasons that a project will succeed are user involvement, executive management support, and a clear statement of requirements. There are other success criteria, but with these three elements in place, the chances of success are much greater. Without them, chance of failure increases dramatically.

Project Success Factors	% of Responses
1. User Involvement	15.9%
2. Executive Management Support	13.9%
3. Clear Statement of Requirements	13.0%
4. Proper Planning	9.6%
5. Realistic Expectations	8.2%
6. Smaller Project Milestones	7.7%
7. Competent Staff	7.2%
8. Ownership	5.3%
9. Clear Vision & Objectives	2.9%
10. Hard-Working, Focused Staff	2.4%
Other	13.9%

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The survey participants were also asked about the factors that cause projects to be challenged.

Project Challenged Factors	% of Responses
1. Lack of User Input	12.8%
2. Incomplete Requirements & Specifications	12.3%
3. Changing Requirements & Specifications	11.8%
4. Lack of Executive Support	7.5%
5. Technology Incompetence	7.0%
6. Lack of Resources	6.4%
7. Unrealistic Expectations	5.9%
8. Unclear Objectives	5.3%
9. Unrealistic Time Frames	4.3%
10. New Technology	3.7%
Other	23.0%

Opinions about why projects are impaired and ultimately cancelled ranked incomplete requirements and lack of user involvement at the top of the list.

Project Impaired Factors	% of Responses
1. Incomplete Requirements	13.1%
2. Lack of User Involvement	12.4%
3. Lack of Resources	10.6%
4. Unrealistic Expectations	9.9%
5. Lack of Executive Support	9.3%
6. Changing Requirements & Specifications	8.7%
7. Lack of Planning	8.1%
8. Didn't Need It Any Longer	7.5%
9. Lack of IT Management	6.2%
10. Technology Illiteracy	4.3%
Other	9.9%

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Another key finding of the survey is that a high percentage of executive managers believe that there are more project failures now than five years ago and ten years ago. This despite the fact that technology has had time to mature.

	Than 5 Years Ago	Than 10 Years Ago
Significantly More Failures	**27%**	**17%**
Somewhat More Failures	**21%**	**29%**
No Change	**11%**	**23%**
Somewhat Fewer Failures	**19%**	**23%**
Significantly Fewer Failures	**22%**	**8%**

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Focus Groups

To augment the survey results, The Standish Group conducted four focus groups with IT executives of major companies. The attendees were from a cross section of industries, including insurance, state and federal government, retail, banking, securities, manufacturing and service. Two of the focus groups were in Boston. The other two, in San Francisco. Each focus group had an average of ten participants with an overall total of forty-one IT executives. The purpose of these particular focus groups was to solicit opinions on why projects fail. In addition, The Standish Group conducted interviews with various IT managers. Some of their comments are enlightening about the variety of problems besetting project development.

Many of the comments echoed the findings of The Standish Group survey. "We have 500 projects. None are on-time and on-budget. This year, 40% will get cancelled," said Edward, Vice President of MIS at a pharmaceutical company.

Other comments went directly to the reasons for failure. Jim, the Director of IT at a major medical equipment manufacturer, said: "Being that it's a mindset, it's very difficult to get all of the management -- it's even on the local level, not even on a worldwide level -- to get all of the management to agree on a set of rules.... That's a challenge in itself because you have to, in some cases, convince them that this is best for the company, not necessarily best for them, but best for the company. And you have to have that buy-in. If you don't have that buy-in, you're going to fail. I don't care how big or how small the project is."

John, Director of MIS at a government agency added: "Probably 90% of application project failure is due to politics!" And Kathy, a programmer at a telecommunication company, offered an even more scathing comment on politics: "Sometimes you have to make a decision you don't like. Even against your own nature. You say well, it's wrong, but you make that decision anyway. It's like taking a hammer to your toe. It hurts."

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Bob, the Director of MIS at a hospital, commented on external factors contributing to project failure. "Our biggest problem is competing priorities," he said. "We just had a reorganisation today. So now that's going to sap all the resources. And explaining to senior management that, 'Well, it's really taking us the time we said it was going to take. But because you've reorganised the company, I'm going to take another six months on this other project, because I'm doing something else for you.' That's the biggest issue I have." Bill, the Director of MIS at a securities firm, added: "Changes, changes, changes; they're the real killers."

Some of the comments were darkly humorous. "Brain-dead users, just plain brain-dead users," said Peter, an application analyst at a bank. "When the projected started to fail," said Paul, a programmer at a personal products manufacturer, "the management got behind it -- way behind."

The comment most indicative of the chaos in project development came from Sid, a project manager at an insurance company. "The project was two years late and three years in development," he said. "We had thirty people on the project. We delivered an application the user didn't need. They had stopped selling the product over a year before."

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Case Studies

For further insight into failure and success, The Standish Group looked carefully at two famous Resolution Type 3 (cancelled) projects and two Resolution Type 1 (successful) projects. For purposes of comparison, the project success criteria from the survey of IT executive managers was used to create a "success potential" chart. The success criteria were then weighted, based on the input from the surveyed IT managers. The most important criterion, "user involvement," was given 19 "success points". The least important -- "hard-working, focused staff" -- was given three points. Two very important success criteria -- "realistic expectations" and "smaller project milestones" -- were weighted at ten and nine points respectively. Finally, as presented later in this report, each of the case studies was graded.

California DMV

In 1987, the California Department of Motor Vehicles (DMV) embarked on a major project to revitalise their drivers license and registration application process. By 1993, after $45 million dollars had already been spent, the project was cancelled.

According to a special report issued by DMV, the primary reason for redeveloping this application was the adoption new technology. They publicly stated: "The specific objective of the 1987 project was to use modern technology to support the DMV mission and sustain its growth by strategically positioning the DMV data processing environment to rapidly respond to change." Also, according to the DMV special report "The phasing was changed several times, but the DMV technical community was never truly confident in its viability...."

The project had no monetary payback, was not supported by executive management, had no user involvement, had poor planning, poor design specifications and unclear objectives. It also did not have the support of the state's information management staff.

The DMV project was not rocket science. There are much harder applications than driver licenses and registrations. But because of internal state politics, unclear objectives, and poor planning, the project was doomed from the start.

American Airlines

Early in 1994, American Airlines settled their lawsuit with Budget Rent-A-Car, Marriott Corp. and Hilton Hotels after the $165 million CONFIRM car rental and hotel reservation system project collapsed into chaos.

This project failed because there were too many cooks and the soup spoiled. Executive management not only supported the project, they were active project managers. Of course, for a project this size to fail, it must have had many flaws. Other major causes included an incomplete statement of requirements, lack of user involvement, and constant changing of requirements and specifications.

Hyatt Hotels

While Marriott and Hilton Hotels were checking out of their failed reservation system, Hyatt was checking in. Today, you can dial from a cellular airplane telephone at 35,000 feet, check into your Hyatt hotel room, schedule the courtesy bus to pick you up, and have your keys waiting for you at the express desk. This new reservation system was ahead of schedule, under budget, with extra features -- for a mere $15 million of cold cash. They used modern, open systems software with an Informix database and the TUXEDO transaction monitor, on Unix-based hardware.

Hyatt had all the right ingredients for success: user involvement, executive management support, a clear statement of requirements, proper planning, and small project milestones.

Banco Itamarati

A year after a strategic redirection, Banco Itamarati, a privately-held Brazilian bank, produced an annual net profit growth of 51% and moved from 47th to 15th place in the Brazilian banking industry. Three fundamental reasons account for Banco Itamarati's success. First, they had a clear vision with documented specific objectives. Second, their top-down level of involvement allowed Banco Itamarati to stay on course. And finally, the bank produced incremental, measurable results throughout the planning/implementation period.

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Banco Itamarati's clear business goal is to be one of Brazil's top five privately-held banks by the year 2000. Their objectives include maintaining a close relationship with their customers to improve and maintain an understanding of their needs, offering competitive financial solutions, guaranteeing customer satisfaction, and finally producing balanced results for the Itamarati Group. Banco Itamarati's objectives were incorporated into a strategic plan that clearly identified measurable results and individual ownership.

Their strategic plan made technology a key component of the business strategy. Itamarati used Itautec's GRIP OLTP monitor as a basic tool for integrating software components. According to Henrique Costabile, Director of Organisation Development, "We are one of the first banks to implement a client-server architecture that maximises the potential of this architecture." Executive leadership, a well-communicated plan, and a skilled diverse team provided the foundation for Banco Itamarati to achieve their long-term goal, potentially ahead of schedule.

Case Study Conclusions

The study of each project included adding up success points on the "success potential" chart.

Success Criteria	Points	DMW	CONFIRM	Hyatt	Itamarati
1. User Involvement	19	No (0)	No (0)	Yes (19)	Yes (19)
2. Executive Management Support	16	No (0)	Yes (16)	Yes (16)	Yes (16)
3. Clear Statement of Requirements	15	No (0)	No (0)	Yes (15)	No (0)
4. Proper Planning	11	No (0)	No (0)	Yes (11)	Yes (11)
5. Realistic Expectations	10	Yes (10)	Yes (10)	Yes (10)	Yes (10)
6. Smaller Project Milestones	9	No (0)	No (0)	Yes (9)	Yes (9)
7. Competent Staff	8	No (0)	No (0)	Yes (8)	Yes (8)
8. Ownership	6	No (0)	No (0)	Yes (6)	Yes (6)
9. Clear Vision & Objectives	3	No (0)	No (0)	Yes (3)	Yes (3)
10. Hard-Working, Focused Staff	3	No (0)	Yes (3)	Yes (3)	Yes (3)
Total	100	10	29	100	85

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With only 10 success points, the DMV project had virtually no chance of success. With 100 success points, Hyatt's reservation project had all the right ingredients for success. With only 29 success points, the CONFIRM project had little chance of success. With 85, Itamarati, while not as assured as Hyatt, started with a high success probability.

The Bridge To Success

Notwithstanding, this study is hardly in-depth enough to provide a real solution to such a daunting problem as the current project failure rates. Application software projects are truly in troubled waters. In order to make order out of the chaos, we need to examine why projects fail. Just like bridges, each major software failure must be investigated, studied, reported and shared.

Because it is the product of the ideas of IT managers, the "Success Potential" chart can be a useful tool for either forecasting the potential success of a project or evaluating project failure.

Research at The Standish Group also indicates that smaller time frames, with delivery of software components early and often, will increase the success rate. Shorter time frames result in an iterative process of design, prototype, develop, test, and deploy small elements. This process is known as "growing" software, as opposed to the old concept of "developing" software. Growing software engages the user earlier, each component has an owner or a small set of owners, and expectations are realistically set. In addition, each software component has a clear and precise statement and set of objectives. Software components and small projects tend to be less complex. Making the projects simpler is a worthwhile endeavour because complexity causes only confusion and increased cost.

There is one final aspect to be considered in any degree of project failure. All success is rooted in either luck or failure. If you begin with luck, you learn nothing but arrogance. However, if you begin with failure and learn to evaluate it, you also learn to succeed. Failure begets knowledge. Out of knowledge you gain wisdom, and it is with wisdom that you can become truly successful.

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