Project success; looking outside traditional project metrics

Brian K. Willard

Roosevelt University

August 3, 2005

Abstract

Project Management has traditionally viewed success and failure based on three metrics. Those being: On Time, On Budget and meets specifications. However, today's IT, and other areas, are looking to the PM's to implement successful systems that actually succeed. The following lists examples of projects that failed in the traditional PM metrics, yet are great successes. In contrast, projects that fully met or exceeded the metrics, yet were complete failure. This demonstrates the need for identifying, and monitoring different metrics at appropriate timeframes and using formal and informal processes for measuring the metrics.

Introduction

Project management has traditionally looked at managing the project implementation process. This view of project management specifically views the project as a task or process that needs to be completed following the specifications, budget and time given. This approach has provided metrics that are universally excepted as cost, schedule and performance (Pinto & Slevin, 1998, p.67; Meredith & Mantel, 2003, pp. 78-85) to evaluate the performance of the project. However, these metrics do not provide the necessary view to the successfulness of the project to the organization/stakeholders. This paper highlights IT project management; but also relates to and specifically sites other areas of project management. In most project management scenarios (construction for example) a project is lead by one individual or a group of individuals as stakeholders and

designates another individual or group (architect(s)) who design the plans. The construction is then managed by a project manager (which could be a dedicated project manager, or a general contractor with that roll). IT, on the other hand, is in a unique situation as many projects are actually created within IT or designed and developed within IT, implemented, presented to the stakeholders for approval and then maintained by the same staff. This further points out the need for looking outside the on time, on budget and based on approved specs when IT may be defining one, two, or all three of the project levels.

What is Project Management

The following definitions show that project management is not as clearly defined or understood:

> "Both a process and set of tools and techniques concerned with defining the project's goal, planning all the work to reach the goal, leading the project and support teams, monitoring progress, and seeing to it that the project is completed in a satisfactory way." (Rosenau, Griffin, Castellion, Anschuetz)

> "A controlled process of initiating, planning, executing, and closing down a project." (Schmitt)

> "May be used in a project manufacturing environment for production scheduling or in a variety of one off projects throughout all types of organization[sic]." (Homer Computer Services)

"The planning, control and co-ordination of all aspects of a project, and the motivation of all those involved in it, in order to achieve the project objectives." (UK Ministry of Defense Acquisition Management System)

"Project management is the ensemble of activities (such as tasks) concerned with successfully achieving a set of goals. This includes planning, scheduling and maintaining progress of the activities that comprise the project. Reduced to its simplest project management is the discipline of maintaining the risk of failure at as low a value as necessary over the lifetime of the project. Risk of failure arises primarily from the presence of uncertainty at all stages of a project." (Wikipedia)
"The art of directing and coordination human and material resources to achieve stated objectives within the limits of time, budget, and client satisfaction" (Wiedman, Modeling Project Management)

"The use of skills and knowledge for co-ordinating[sic] the organization, planning, scheduling, directing, controlling, monitoring and evaluating of prescribed activities to ensure that the stated objectives of a project are achieved." (4ETO)

"A set of well-defined methods and techniques for managing a team of people to accomplish a series of work tasks within a well-defined schedule and budget." (The Balanced Scorecard Institute)

> "Planning, monitoring and control of all aspects of a project and the motivation of all those involved in it to achieve the project objectives on time and to specified cost, quality and performance." (Association of Project Management)
>
> "Project management is the systematic planning, organizing and controlling of allocated resources to accomplish project cost, time and performance objectives." (Treasury Board of Canada)
>
> "Project management is concerned with the overall planning and co-ordination of a project from inception to completion aimed at meeting the client's requirements and ensuring completion on time, within cost and to required quality standards." (European Council for Building Professionals)
>
> "Approach used to manage work with the constraints of time, cost and performance targets." (Welcom)

In reviewing the definitions above, which come from all over the world, a large number of originations and institutions define project management by the success metrics of "On Time, On Budget and As Defined". I believe this view comes from the historical foundation of Project Managements roll. "It is common for project management literature to confusingly intertwine these two separate components of project success [Project management success & Product success] and present them as a single homogenous group." (Baccarini, pp 1) This view is now starting to be challenged as project management matures and has been adopted by business as a way to implement

systems, processes, and products within an organization. Although, still critical in the project management process, project managers are being asked to accomplish more than just the delivery of the project.

Project Creation

To look at the change in the project managers roll, we must look at the history of project management. "Historically, project management responded to the need to create civil and building works of some complexity" (Wideman, pp.1 Improving PM: …). Project management was primarily founded on taking a clearly defined and approved project through implementation. That model works fine under traditional construction implementation where an individual or group of individuals define the finished product (structure) and hire architect(s) to define the structure. The project manager is given the time, cost and blueprints and is then instructed to "Make it happen". Once completed, the project manager moves on to the next project.

This is contrary to how a large number of business projects are now being created and implemented. This is where a problem is identified, sometimes by the individual who will be the project manager. Then a business case is developed, and many times this is done by the project manager, which is then submitted to management for approval. If approved, the project manager then has to perform the standard roll of implementing the project. After implementation, the project manager may also be responsible for continued maintenance and support of the process, product, system, etc. This scenario is especially

true in IT implementations, where rollout, training and ongoing support is part of or/and follows implementation.

This change in project creation has major implications, as the project sponsors, stakeholders or/and company management is looking to the project manager to not just successfully implement each project, but to estimate ROI/ROV (Return on Investment / Return on Value) and other metrics during the project evaluation phase that can be monitored and evaluated during and after implementation. Unfortunately, project teams do not do a post implementation audit. After implementation, even when a post implementation audit is performed, ROI is rarely measured as "With IT purchases, there's no set formula [for ROI] because the sum of the gains is difficult to quantify." (Contino, pp 39).

Project Success – as commonly measured

What constitutes project success? As the previously listed definitions of project management show, many individuals define project management as meeting the budget, meeting the time schedule, and conforming to the requirements. This prevalence is so ingrained, that the Standish Group has gathered statistics since 1994 on projects in IT that succeeded, failed or were "challenged".

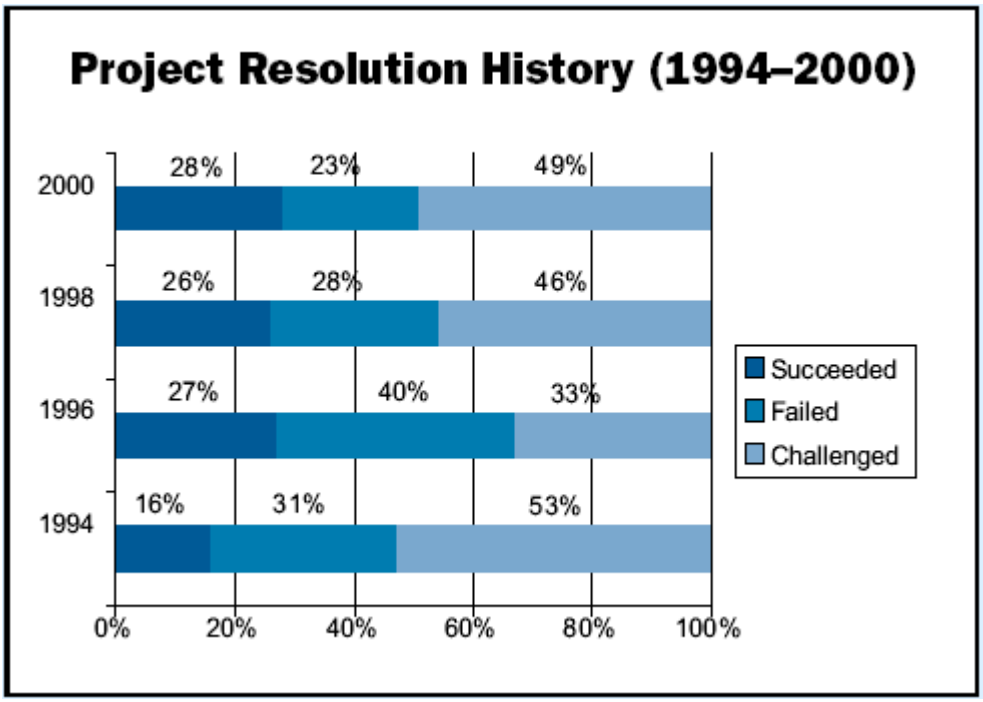
"The Standish Group categorizes projects into three resolutions types:

- Successful: The project is completed on time and on budget, with all features and functions originally specified.

- Challenged: The project is completed and operational, but over-budget, over the time estimate, and with fewer features and functions than initially specified.
- Failed: The project is cancelled before completion or never implemented."

(Standish Group)

According to the 2001 extreme CHAOS report, the following graph shows that only 16% - 28% are considered a success.



With an average success rate of less than 30%, why are so many projects started? Or a better question; why are projects that are "Challenged", the largest percentage, allowed to be fully implemented? There is obviously benefits to the originations that are implementing these projects for such a large percentage of "Challenged" projects to continue until completion.

Project Success – A different view

Project success tends to measured by the big three (cost, time, requirements met) as they are easy and timely to measure. With standard project management techniques, you can identify at any given point if you are currently a successful project, or a challenged one.

This only provides a view as to the success of the project management process. "This focuses upon the project process and, in particular, the successful accomplishment of cost, time and quality objectives. It also considers the manner in which the project management process was conducted. " (Baccarini, pp 25) This approach does not accurately deal with the issues facing the project manager under many current business contentions. "Clearly, the old adage of on time, on budget, and (even) conformance to requirements are not, of themselves, satisfactory success criteria (Wideman, pp.1 Improving PM: …).

Baccaini also includes the term "Product Success – this deals with the effects of the project's final product". He points out that "It is common for project management literature to confusingly intertwine the two separate components of project success" (Baccarini, David, pp 25) when referring to 'project management success and 'product success. "No system of project metrics is complete without both sets of measures (performance and success)…" (Cooke-Davies, T, pp 188)

This also leaves out one important fact; that the original specifications may not have been correct, the budget allocated to the project may have been inaccurate, and the time estimate may have been flawed. This is often perpetuated by a manager or/and stakeholder, in his/her zeal to get a project started, will try to make the ROI (Return on Investment) look the absolute best. One of the easiest ways is to increase ROI is to have the implementation costs as low as possible. This sometimes is done with best case scenarios or wild guesses on the time and cost of the project. Also the ramifications and true requirements may not be fully understood and may cause significant cost and time over-runs.

Management has traditionally turned a blind eye to this as once a project is implemented, everyone starts working on other projects or/and in the support of the new process/system/product. Very rarely is a 'Post Implementation Audit' done, and when done rarely does it measure the actual ROI; leaving the individuals creating the project request specifications to be free from repercussions in the event of overruns in the project.

This approach leaves the Project Manager without any feedback mechanisms except for the ones he/she can monitor, which puts us back to the Quality, Cost & Speed metrics. However this does not provide any indication as to the success of the project to the organization. Is it possible that a percentage of the "Challenged" projects are actually successes to the organization and vice-versa, a percentage of the "Successful" projects are really failures?

Project Success & Failures

So how does one determine if a project is successful? Lets first look at some examples and see if the traditional metrics are valid.

One of the difficulties is that most case studies and project management examples only provide examples of success. Those that do show failure are usually ones that are government or public works projects. This makes examples like the following difficult to identify.

The following are examples that were provided by Hugh Woodward, PMP:

1. **Sydney Opera House**. With its graceful sails dominating Sydney Harbor, the Sydney Opera House is arguably one of the most recognized buildings in the world. Yet, from a project management perspective, it was a spectacular failure. When construction started in 1959, it was estimated to cost $7 million, and take four years to build. It was finally completed in 1973 for over $100 million (Architecture Week, 2003).

2. **2002 Olympic Winter Games**. The 2002 Olympic Winter Games was a very successful project from a project management perspective, winning designation as PMI's 2003 International Project of the Year (Foti, 2004). It achieved the key dates, of course. But it deviated from the conventional approach to "success" with respect to its cost performance. The project managers boast that they turned a $100 million deficit into a $400 million surplus, not just by eliminating "nice-to-have"

items, but by also securing additional funds. Clearly, success was measured by profitability, not by achieving a specific cost target.

3. **Batu Hijau Copper Concentrator**. PT Newmont Nusa Tenggara's Batu Hijau copper concentrator was the world's largest "greenfield" startup when it was commissioned in September 1999 (Enos & Rogers, 2002). It was an extremely complex construction project located on the remote Indonesian island of Sumbawa involving 1,704,000 design hours, 48,791,000 construction hours, 551 separate systems, and 19,200 engineering drawings and documents. Nevertheless, it was completed one month ahead of schedule and $100 million under budget. It was considered very successful, but not merely because of its cost and schedule performance. Rather, it was viewed as successful because the production ramp-up was faster than expected, producing a cash flow from operations exceeding 200% of budget within a year after start-up. In this case, the project team focused on the real objective which was to produce copper concentrate, not to achieve the cost and schedule targets.

4. **Project Orion**. This massive effort to develop Kodak's new Advantix photographic system was reputedly very well managed from a project management perspective. PMI recognized it as the 1997 International Project of the Year, and Business Week selected the system as one of the best new products of 1996 (Adams, 1998). But Kodak's stock price has fallen 67% since the introduction of

the Advantix system, in part because it failed to anticipate the accelerating switch to digital photography (Bandler, 2003).

5. **Corporate Intranet**. Finch (2003) describes a project which involved the implementation of a corporate intranet to globalize and improve communications. From a traditional project perspective, it failed to meet its success criteria, but not significantly. It was one month late and believed to have been accomplished with a small budget overrun. But both the project manager and senior management viewed the project as successful. The hardware and software had been installed successfully with a minimum of disruption, thereby providing all staff members with access to the corporate intranet. Following implementation, however, employees made only limited use of the intranet facilities. The main objective of the project was therefore not achieved. In this case, both the project manager and senior management focused on an objective that was too narrow.

6. **Plant Water Conservation**. A manufacturing plant in a semi-arid part of the USA was ordered to reduce its water consumption by 10%. Although the plant was already one of the most water-efficient facilities of its kind in the world, the project team compiled a list of additional recycling and conservation measures, and began implementation. Several months later, the company decided to close down an orange juice facility that happened to be located at the same site, thereby reducing water consumption by almost enough to meet the mandated target. The project team was thus able to return the unspent funds to the company. Had it been focused

on implementing the project scope according to the initial plan, this opportunity to achieve the real goal without additional spending would have been missed.

7. **Manufacturing Plant Optimization**. A paper manufacturing company with five plants across North America decided to increase its manufacturing capacity by embarking on a de-bottlenecking program. A project team was formed to install the necessary equipment, and charged with completing the work in 18 months at a cost of $26 million. But almost immediately, the project team was asked to defer major expenditures until an unrelated cash flow problem was resolved. Rather than stop work completely, the team adopted a strategy of prototyping the technologies on which the de-bottlenecking program was based, and actually developed some cheaper and more effective solutions. Even when the project was authorized to proceed, the team continued this same approach. The project eventually spanned five years, but the resulting capacity increase was three times the initial commitment. Not surprisingly, the company immediately appropriated another $40 million to continue the program.

8. **Laptop Upgrade**. The IT division of major international company was upgrading all the employee workstations to a new platform. Because the laptops used by the sales division were near the end of their leases, the project manager decided to issue new laptops with the new platform already installed, thus significantly reducing the overall project cost. Unfortunately, once this decision was made, schedule became the critical project objective, and the fact that the new platform

was incompatible with some unique software used by the sales division was completely overlooked. The inevitable result was an enormous productivity loss, for both the project team and the sales division.

9. **Senior Citizens Center Relocation**. A senior citizens center in a small US city was granted a parcel of land to construct a new state-of-the-art facility. They immediately began preparing to move, and engaged an architect to develop the plans. They also recognized they would need additional revenue to operate the new facility and that the necessary funds were available from government sources provided the center was accredited. Therefore, they also engaged a consultant to pursue accreditation. Both projects proceeded independently for several months, and would have continued except for a chance meeting between the architect and the consultant. After discussing their respective work, they realized that the accreditation criteria required certain building features that the architect had not incorporated. Scarce funds had already been wasted, but that chance meeting narrowly averted a further $500,000 in re-work.

(Woodward, Hugh, Beyond Cost, Schedule…, pp 2 & 3)

So in the previous examples, which ones were successful? Is it the ones that met the traditional metrics? Examples like the 2002 Winter Olympics and the Fatu Hijau Copper Concentrator would suggest that. As they met the traditional project managers' definition of success, in addition, they met the projects sponsors perception of success.

As we start to look at the examples like Project Orion, the Corporate Intranet and the Laptop Upgrade, we notice that the traditional metrics start to fail. These projects are considered successes in project managers' definition of success, but failed at meeting the sponsors' success criteria. The project Orion example is quite astounding as this project was recognized by PMI (Project Management International) in 1997 as the International project of the year. Yet it did not increase Kodak's revenue, as they did not foresee the adoption of digital cameras.

Most interesting are the examples of the Manufacturing Plant Optimization and the Sydney Opera House. They both failed to meet the traditional project managers' success metrics but were considered successes. This is particularly shocking when you see that the Sydney Opera House had a "cost overrun of 1300%" and a "schedule overrun of 250%". (Woodward, Hugh, Project Success…, 2005)

Once we realize that projects can fail to meet the traditional metrics of success, but still be successful to the stakeholders, this creates a quandary for the project manager. How does one really define success? Is it possible that a "Challenged" project could be canceled that would have met the sponsors' needs? Is it also possible to identify a project that should be canceled that is currently on time, on budget and meeting the defined needs?

Project Success – New Metrics and Measurements

While not suggesting that project managers 'through the baby out with the bathwater' and eliminate the traditional PM metrics; it is obvious that additional metrics and measurements need to be added to the project managers' toolbox.

Project justification should be expanded & refined. Simply looking at the ROI for project justification is shortsighted, and usually incorrect. Metrics should be identified as to how an implementation will benefit the core business directives or mission statement. Also Identification of how success of the project will actually be measured once implemented. Most importantly, is the when will the measurements be done.

Organizations, vendors and project managers should spend adequate time defining metrics, monitoring techniques and timetables at the very beginning of a project that relate to the following categories and possible metrics:

Category	Metrics
Project management	Project Time Project Cost Project accuracy (specifications met) Change requests Quality Safety (if applicable)
Project success	Benefit(s) to the organization Stakeholder satisfaction Users satisfaction Number of issues recorded since implementation Ease of use/quantity of use Happiness/willingness of end users Solved problem(s) project was intended to solve Un-intentional improvement/complication to processes/procedures
Business success	Cost savings / cost reductions ROI (Return on Investment) Return on expectations Competitive advantage Improved operating efficiencies Opportunities in the future Expanding or improving core competency Enhance productivity Reducing paperwork Reducing manual processes Real time processing/real time reports Increased accuracy / quality improvements Customer service improvements Resource management improvements Support business growth Building external linkages Increased flexibility Empowerment

(Shang & Seddon, pp. 277), (Bernthal, pp. 54), (Cooke-Davies, pp. 7), (Wideman, 2002, pp. 2), (Tomkins & Hall, pp. 45)

Many project managers do not do a post implementation audit, but this is essential to reviewing the success, failures, challenges and lessons learned. For those who do them, it is usually within a month or two of completion of the project and usually focuses on the traditional metrics, success/failures and how the project team did in performing the project implementation. However, many projects, including IT projects, this may not be enough time to get a clear picture of the success/failure of the project. To demonstrate how time plays a factor in demonstrating how time plays a factor in monitoring success/failure metrics, consider the Empire State building (ESB):

> The building was the brain-child of John J. Raskob, the vice-president of General Motors, who wanted this new building to exceed the height of the rival car manufacturer's Chrysler Building, still under construction when the plans were released on August 29, 1929. The program given to the architects called for a tight schedule of completion one and a half years after the start of the project. (New York Skyscrapers – One Hundred Years of High-Rises)

> The Empire State Building in New York city was completed "[in] One year and 45 days… (ahead of schedule)" " Cost $40,948,900 (including land). Building Alone $24,718,000 (the onset of the depression halved the anticipate cost of the building.)" (Empire State Building Official Internet Site)

So the ESB was complete ahead of schedule, under budget, and was to the specifications as designed. If the measurement was to be done on traditional PM metrics the project would be a complete success! However, if the metrics also looked at rented space… it would tell a completely different story. For the very reason that it came in at half the production cost

(the great depression), rental rates at the buildings opening was a meager 20%. In fact it was nicknamed the "Empty State Building." So if measured on rented space on completion of the project, it would be a failure. So let's expand the time-line, you have to go to 1948 or 17 years later for the building to have enough tenants to turn a profit. But today it is again the tallest building in New York, and has always been a representation of NY and as of 2002 was 97% occupied.

That example brings up an important point. That success metrics may need to be monitored over a period of time to determine the true success/failure of the project, this may or may not be possible at, or just after, implementation time.

This Time factor of measurement is very import, as many projects are either creating something new, or implementing a new process or/and system. Metrics that look at many of the goals of a system need time to realize there true impact, "…despite management's introduction of an extensive set of organizational change initiatives, managerial goals of improved flexibility and responsiveness are not immediately attained." (Melville, 2004)

One last important metric is 'use' . Whether it is in construction, like the above ESB, or a computer system; it is the use of the final product that ultimately decides the success of many projects. This should be an important metric that is identified during project approval and monitored throughout product testing and rollout.

In Michael Schrage's July 15th 2005 article in CIO Magazine "IT's Hardest Puzzle" Michael describes a CMR system implementation that was done on time and within

budget. "However, the first six months of the CRM deployment ended up costing the company more money per unit sale. Even worse, the company's threats to discipline the salespeople who had gamed the CRM ruined the sales force's desire to work with the system. The vice president of sales made such a fuss about how his most creative salespeople were being "punished" for their ingenuity that harsh words were exchanged. He was asked to leave." In addition, Customer Service had conflicts with marketing and multiple systems to juggle. "As a result, customer satisfaction dropped."

"The lesson here is simple: Whether CIOs implement ERPs, SCMs or CRMs, only the most naive C-level executive focuses on whether the system actually works. Success will be—and should be—measured by how well that system is used."

(Schrage, IT's Hardest Puzzle)

Conclusion

Traditional Project Management metrics have served the PM community well over the years. However, these metrics are very often shortsighted in their view of whether a project will ultimately be successful or a failure in real business measurements. Identifying metrics and monitoring them throughout the process and as one or more post implementation audits is essential to fully understanding the success of the project in both implementation and business perspectives. The PM needs to not strictly focus on the specs, money and time; in many cases, this shortsightedness may doom a projects ultimate goal.

Acknowledgment

I would like to thank the following two individuals for the assistance in the research of this paper:

R. Max Wideman, who spent an hour on the phone with me from his office in Alberta, BC, Canada. His insight and guidance pointed me in the right direction of finding key words for my research.

Hugh Woodward Managing Editor of PMFORUM.ORG, who sent me the paper that his NASA presentation was based on. Its documented success and failure examples filled the final hole in my research.

References

4ETO, Available On-Line at http://www.4eto.co.uk/ERP-Dictionary-Capacity-Planning-Resource-Planning.asp

Association of Project Management, *Glossary of Project Management Terms*, Available On-Line at: http://www.apm.org.uk/PtoQ.asp

Baccarini, David, 1999, pp. 25-32, *The logical framework method for defining project success*, Project Management Journal, 30 (4)

Balanced Scorecard Institute, Available On-Line at: http://www.balancedscorecard.org/basics/definitions.html

Bernthal, Paul, May 2005, pp. 53-56, *Measurement Gets Strategic*, T+D Magazine, 59 (5)

Contino, Diana S, RN, CNE, CCRN, MBA, Feb 2004, pp. 39-40, *What's your project's ROI* ,Nursing Management, 35 (2)

Cooke-Davies, Terry, March 2004, pp. 6-8, *Consistently doing the right projects and doing them right" What metrics do you need?*, Journal of the Australian Institute of Project Management, 24 (1)

Cooke-Davies, Terry, April 2002, pp. 185-190, *The "real" success factors on projects,* International journal of project management, 20 (3)

Empire State Building Official Internet Site, Available On-Line at: http://www.esbnyc.com/tourism/tourism_facts.cfm?CFID=12785157&CFTOKEN=39943723)

European Council for Building Professionals, *Glossary of Construction,* Available On-Line at: http://www.ecbp.org/glossary.htm

Homer Computer Services, Available on-line at: http://www.homercomputer.com.au/homer_software_guide/glossary.htm

Melville, Nigel, June 2004, pp 283-322, *Review: Information Technology and Organizational Performance: An Integrative Model of IT Business Value*, MIS Quarterly, 28 (2)

Meredith, J.R. & Mantel, S., 2003, pp. 78-85, *Project management: a managerial* approach, John Wiley & Sons, New York New York.

New York Skyscrapers – One Hundred Years of High-Rises, Available On-Line at: http://www.greatgridlock.net/NYC/nyc2a.html

Pinto, J.K. & Slevin, D.P., 1998, pp. 67-73, *Project success: definitions and measurement techniques*, Project Management Journal, 19 (3)

Rosenau, Griffin, Castellion, Anschuetz , 1996, glossary, *The PDMA Handbook of New Product Development*, John Wiley & Sons, New York, 1996.

Schmitt, Dr. Lawrence, Available online at: http://www.cbu.edu/~lschmitt/I351/glossary.htm

Schrage, Michael, July 15, 2005, *IT's Hardest Puzzle*, CIO, Available On-Line at: http://www.cio.com/archive/071505/leadership.html

Shang, Shari & Seddon, Peter B., October 2002, pp. 271 – 299, *Assessing and managing the benefits of enterprise systems: the business manager's perspective* Information Systems Journal, 12 (4)

Standish Group, *Extreme CHAOS (2001)*, pp 2, Available On-Line at: http://www.standishgroup.com/sample_research/PDFpages/extreme_chaos.pdf

Tompkins, James A., Hall, Bill; July 2001, pp. 43-46, *Did you get what you expected?*, IIE Solutions, 33 (7)

Treasury Board of Canada, *Capital Plans – Glossary*, Available On-Line at: http://www.tbs-sct.gc.ca/pubs_pol/dcgpubs/TBM_122/abkglos-1_e.asp

UK Ministry of Defense Acquisition Management System, Available on-line at: http://www.ams.mod.uk/ams/content/docs/ils/ils_web/glossary.htm

Welcom, *PM Glossary*, Available On-Line at: http://www.welcom.com/content.cfm?page=256#Project%20Management

Wiedman, R.M., *Improving PM: Linking Success Criteria to Project Type*, Available On-Line at: http://www.maxwideman.com/papers/improvingpm/improvingpm.pdf

Wiedman, R.M., *Modeling Project Management*, Available On-Line at: http://www.maxwideman.com/papers/pm-models/pm-models.pdf

Wikipedia, Available On-Line at: http://en.wikipedia.org/wiki/Project_management

Woodward, Hugh PMP, Managing Editor of PMFORUM.ORG, *Beyond Cost, Schedule and Performance: Project Success as the Customer Sees It*, unpublished to my knowledge (sent directly to me via e-mail by the author)

Woodward, Hugh PMP, PowerPoint Presentation to NASA on March 23, 2005, Available On-Line at: http://pmchallenge.gsfc.nasa.gov/Docs/Presentations2005-speakers/Day%202/AllAboutYou/HughWoodward.pdf