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(published jointly with Novática*)

Guest Editors: *Darren Dalcher and Luis Fernández-Sanz*

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Software Project Success: Moving Beyond Failure

Darren Dalcher

Success and failure in software projects appear to be difficult to define. While there is a consensus around the prevalence of project failure, new projects seem destined to repeat past mistakes. This paper tries to advance the discussion by offering a new perspective for reasoning about the meaning of success and the different types of failures. In order to court project success, practitioners need to rise beyond a fixation with internal parameters of efficiency to recognise the role of quality in bringing about the effectiveness required to secure project success. The paper begins by discussing project failure surveys and the impact of project constraints before offering a richer model that identifies the crucial role of quality in securing future success. The paper concludes by introducing a series of mini- case studies that help in making sense of success and failure and in particular highlight the interplay between the four levels of success.

Keywords: Effectiveness, Efficiency, IT Project Failure, Levels of Project Success, Project Failure, Project Management, Project Outcome, Project Output, Project Quality, Project Success, Quality, Software Project Management, Software Projects, The Triple Constraint.

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1 Starting with Project Failure

Popular computing literature is awash with stories of IS development failures and their adverse impact on individuals, organizations, and societal infrastructure. Indeed, contemporary software development practice is regularly characterized by runaway projects, late delivery, exceeded budgets, reduced functionality, and questionable quality that often results in cancellations, reduced scope, and significant re-work cycles [1].

The net result is an accumulation of waste, typically measured in financial terms. For example, in 1995, failed US projects cost $81 billion, with an additional $59 billion overspend, totalling $140 billion [2]. Jones contended that the average US cancelled project was a year late, having consumed 200% of its expected budget at the point of cancellation [3]. In 1996, failed projects alone totalled an estimated $100 billion [4]. In 1998, 28% of projects failed, at a cost of $75 billion, while in 2000, 65,000 US projects were reported to be failing [2].

IT failure is not a new phenomenon. Thirty years ago a GAO report in the US [5] showed that there were serious problems associated with the development of software. Less than 2% of the total value of contracts could be used efficiently as delivered and a further 3% could only be used after changes. The rest of the projects had the software delivered but never successfully used; the software paid for but not delivered; or the software used but extensively reworked or later abandoned. Moreover, the first edition of the best-selling book on software engineering, *The Mythical Man-Month: Essays on Software Engineering*, tells the story, from the perspective of the project manager trying to stabilize the project, of a huge IBM software project with major cost and schedule delays which teetered on the brink of disaster for a number of years [6]. Indeed, the OS360 project came close to bankrupting IBM.

Failures tell a potentially grim tale. In 1995, 31.1% of US software projects were cancelled, while 52.7% were completed late, over budget (cost 189% of their original budget), and lacked essential functionality. Only 16.2% of projects were completed on time and within budget; only 9% in larger companies, where completed projects had an average desired functionality of 42% [2]. The 1996 cancellation figure rose to 40% [2] before improving to around 15% in 2002 (see Figure 1). However, the most recent figures reveal that the current failure rate is 24% [7][8].

While the scientific approach used by the Standish Group has been challenged over the methodology adopted and its rigour, the figures provide a useful baseline related to project failures. Other studies appear to confirm the high failure rates. For example, in 2004 a PriceWaterhouseCoopers study surveyed 10,640 projects and revealed that only 2.5% of companies achieve budget, scope, and schedule targets in all their projects. More recently, McManus and Wood-Harper discovered that only one in eight IT projects can be considered to be truly successful [9].

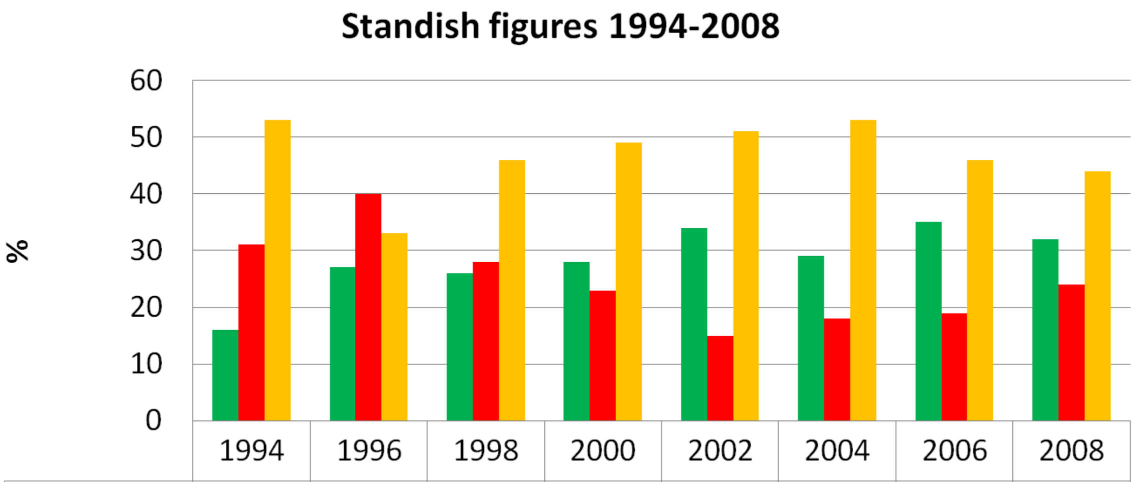
2 Beyond Simple Success Measures

The relationship between success and failure is not clear. Some view the relationship as a binary function so that a project is either successful or not. Research by McManus and Wood-Harper describes failure as "*those projects that do not meet the original time, cost and requirements criteria*". The Standish Group makes a further distinction between failed projects and challenged projects. Failed projects are cancelled before completion, never implemented, or scrapped following installation. Challenged projects are completed and operational projects which are over-budget, late, and with fewer features and functions than initially specified. Successful projects however are completed on time, on budget, with all specified features. Figure 1 shows the relationship between successful, challenged and failed projects. Observing the Standish figures over the past 15 years there would appear to be a rough rule of thumb suggesting a split of 25% of projects being successful, 50% being challenged, and 25% failing.

The Oxford Dictionary defines success as a favourable outcome; doing what was desired or attempted; the accomplishment of an aim or purpose; or the attainment of wealth or fame or position. Failure is broadly defined as lack of success supporting the idea of a binary relationship. In an attempt to make further sense of the relative positions of success and failure software surveys have clearly found it useful to introduce the idea of partial failure (or challenged projects) as an intermediate position between success and failure, potentially indicating dissatisfaction with a two state explanation. Indeed many project outcomes do not fall directly into either category.

The above studies define success as meeting all the criteria associated with the budget, schedule and functionality, or scope; with failure viewed as a failure to meet all of the same criteria. This implies that if a project is finished on time, within budget and to quality (or covering the anticipated scope) it can be viewed as successful. Conversely, failing to meet any of the criteria will deem it a failure. The view is predicated on the traditional measures applied in project management and generally known as the triple constraint, the golden triangle, or the iron triangle.

Traditional theory holds that optimizing the three criteria will result in ideal performance on the project. Typical projects require a balancing act between the triple constraints of budget, schedule, and scope (see Figure 2). Tradeoffs and adjustments are therefore made by restricting, adding to, or adjusting the cost, time and scope associated with



	1994	1996	1998	2000	2002	2004	2006	2008
Succeeded	16	27	26	28	34	29	35	32
Failed	31	40	28	23	15	18	19	24
Challenged	53	33	46	49	51	53	46	44

Figure 1: Standish Figures 1994-2008.

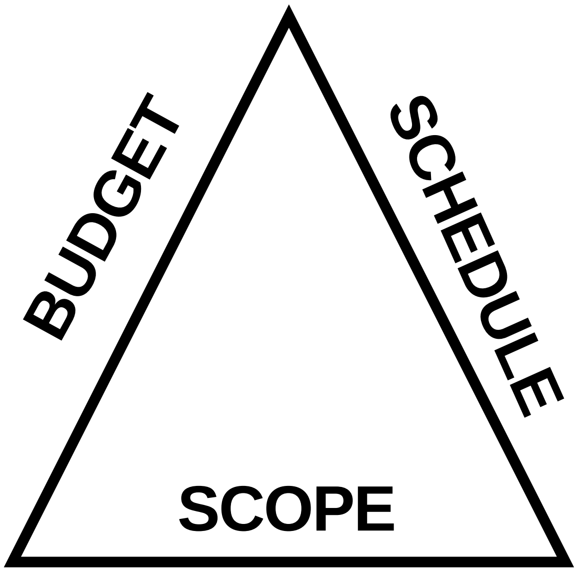


Figure 2: Budget, Schedule and Scope Trade-off .

a project. Indeed the traditional triangle in project management is said to be concerned with finding a balance between cost, time and scope. For example, the more that is requested in terms of scope (or arguably even the performance or the quality), the more it is likely to cost and the longer the expected duration. If the client needs to have a certain performance delivered very rapidly, this will increase the cost due to the need to work faster and have more people involved in the development. The more features expected from a system, the higher the cost and the longer the expected duration. Conversely, if the costs need to be kept to a minimum, one may need to consider the essential performance, or the overall scope, and compromise there [10].

Many managers quickly discover that the triangle is not flexible. The three factors are closely entwined and project managers are expected to balance the **what** (scope) with the **when** (schedule) and the **how much** (budget). In practice, performance and scope are often determined prior to the project. Moreover, project managers often inherit the overall budget from the contracting activities that may even have imposed a fixed-price contract structure. A fixed overall budget may also exclude typical remedies like the hiring of specialists and the addition of human resources. The only remaining scope for leverage is in the schedule. However, this may also be imposed on a project through a fixed date for delivery with little regard to the complexity of the intended system or the risks it embodies. Once both budget and schedule are fixed, there appears to be little scope for compromises and tradeoffs.

The three factors thus play a key part in determining the degree to which a project is challenged (or even deemed a failure), yet they may be uncontrollable by the project manager. Indeed, Capers Jones observed that the most common constraints encountered are: fixed delivery dates; fixed-price contracts; staffing or team size limitations; and performance or throughput constraints [11] i.e. fixed time, price, staffing level, performance and scope. Many managers are thus looking to control other factors that may alter the outcome of the project, especially as the constraints often occur in concert. Measuring success on the basis of pre-established parameters that cannot be adjusted is therefore of limited value.

Before addressing additional factors in the next section it is also useful to point out that the artefacts of projects interact with organizations, customers, stakeholders, and other systems. Their impacts, regardless of whether or not they are delivered on time, can be crucial and perhaps even fatal in financial or real terms. Dalcher reports on the impact of an ambulance despatch system that was delivered to the users (at the third attempt), yet failed in action subsequently, potentially leading to loss of life [12].

Another illustration is a UK disaster which followed an earlier, yet unrelated, failure. The delay in introducing the Nirs2 system into the Inland Revenue beginning in 1995 meant that additional backlogs were building up. The backlogs caused the Inland Revenue to stop sending reminders to up to a third of the UK working force warning them that they needed to top up their national insurance contributions. As a result around 10 million people face a state pension shortfall. The impacted party includes the lowest paid workers in the UK. While the backlog resulted from a delayed system that itself cost tax payers millions of pounds, the additional loss will be borne by individuals and only count as a hidden backlog indirectly stemming from another failure. The true cost to individuals is likely to be £15 billion and the hardship that ensues as a result [13].

The success, and failure, of IT projects therefore cannot be delimited by a simplified set of factors and constraints associated with the delivery effort.

3 Making Sense of Project Success

Project success is a rather nebulous concept and the focus on the triple constraint can be too limiting. Indeed, Linbeg asserted that a whole new theory of project success is needed [14]. Pinto and Slevin noted that success combines issues related to the project itself with issues related to the client [15]. Moreover, software developers and systems analysts have recognized long ago that user involvement, satisfaction and buy-in are crucial to the success of IT projects. Prototyping and user-driven approaches were developed to maximize the potential for satisfaction for various stakeholders and thus increase the likelihood of user acceptance of the ultimate system.

Baccarini identifies the need to distinguish between project management success and the success of the product which entails dealing with the effects of the project's final delivered product [16] thereby allaying the need to define a further dimension concerned with client expectations. Given that the product will be used by the client, there is a degree of similarity between the dichotomies put forward by Pinto and Slevin and by Baccarini. Cooke-Davies likewise makes a distinction between the focus on performance and the need to look at the success of a project [17].

Having multiple categories would suggest that it is possible to be successful in some areas and not successful in others. It thus makes it possible to understand mismatches between the different criteria and groups. Moreover, it implies that the traditional triple constraints of costs, time and performance only reveal part of the picture. In other words, it may be possible to maximize the traditional criteria and yet deliver a product that is not valued by the users. Likewise it is also possible to exceed the traditional criteria but deliver a product that is valued and adopted by the user community, despite exceeding the budget or the schedule.

Crucial Issues in Failures
Relationship management
Trust
Communication
Management of expectations
Politics
Risk management
Escalation
Contract management

Table 1: Crucial Issues in Failures.

The discussion so far indicates that at least two different levels of success can be identified. However most studies and surveys of IT project failures tend to focus on the traditional criteria of efficiency embedded through the triple constraints of time, money and scope/functionality/quality. They thus ignore the deeper aspects associated with the delivered product, its perceived utility and value, the expectations and needs of stakeholders and the project context. Further evidence of the need to look beyond the traditional criteria is provided through Table 1 which summarizes a set of common issues that were identified across six project failures from a cross-section of projects, which were discussed in detail in the same journal [18]. Each case was analysed in detail enabling the authors to identify the causes and effects related to the failures. The obvious message from the list is that the traditional efficiency criteria as embedded in the triple constraint do not appear to have played a part in the build-up to each of the failures. Instead the issues identified were more concerned with the product (as well as the assumptions and expectations surrounding it) and the overall business success.

It is also instructive to scrutinise other domains and sectors. When the UK government recognized that the construction sector was underachieving, it assigned a task force to determine the causes of the shortfall. The study recommended substantial changes in the culture and structure. Crucially it perceived the need to replace competitive tendering with long term relationships to address the growing dissatisfaction of both private and public sector clients. The main criticism was reserved for the way projects were assessed as the focus on time, budget and quality was wholly inadequate. Overall, the task force acknowledged that the construction sector failed to meet the needs of modern business.

4 Towards Multiple Levels of Success

Acknowledging the role of modern business in all projects makes a case for adopting a wider perspective of success that encompasses the various levels and ideas explored in this discussion. A tabular representation of four levels of success is offered in Table 2 [19].

Level 1 represents project management success and is thus concerned with internal efficiency and performance measurement and optimization at the project level through the tracking of the budget, schedule and scope, or functionality, parameters. Level 1 success is therefore to do with project delivery against the constraints or measures imposed on the project.

Level 2 is focused on the overall effectiveness of the project through the lens of what is actually being delivered. Success is measured through the quality and acceptability of the output that has been delivered. The benefits of the projects and the achievement of the objectives are thus assessed in terms of the satisfaction of the customer and the different stakeholder groups. Level 2 success reflects the acceptability of the resulting artefact and the benefit that it delivers, the degree to which it is used, the qual-

Levels of Project Success	
Level 1: Project management success	**efficiency and performance**
Level 2: Project success	**objectives, benefits, stakeholder**
Level 3: Business Success	**value creation and delivery**
Level 4: Future potential	**new markets, skills, opportunities**

Table 2: Levels of Success.

ity built into it, the match with project objectives and requirements, the relationship with the various stakeholder groups, and the overall impact on the customer.

Level 3 is centred on business efficiency which is assessed through the creation and delivery of internal value. The outcome of the project contributes to business success through the satisfaction of business objectives that have been realised. Success equates to maximization of financial and business efficiency measures, such as sales, profits or ROI (Return On Investment), as well as delivered value measures.

Level 4 is forward looking and opportunistic and enhances the business horizon by projecting future gains and opening new avenues, capabilities, skills and markets. Strategic opportunities require a continuous and long-term approach that seeks to derive not just immediate benefit but also to maximize opportunities for cornering the market, creating killer applications, and building the potential for self-enhancing positive feedback loops to secure future growth. Level 4 success is achieved through the realization of new opportunities and harnessing of new potential. It may include new uses or ideas that were not originally considered as well as the development of new competence or capability.

5 Mapping Success

It is interesting to note the horizon of activity for each of the levels of success. Level 1, Project management success is concerned with the execution of the project itself based on the performance against internally established constraints. Success at this level is determined upon delivery of the project, or even through the incremental delivery of

Focus vs. Output/Outcome	Output	Outcome
External Focus	Level 2: Project success Quality of deliverables and other outputs (stakeholder view)	Level 4: Future potential success Business potential and wider implications (to shareholders)
Internal Focus	Level 1: Project management success Internal measures and constraints	Level 3: Business success Internal business value realized following project investment

Table 3: Focus vs. Output/Outcome

Effectiveness/Efficiency vs. Timing Orientation	Short Term	Long Term
Effectiveness	Level 2: Project success Quality of output; completeness, addressing true needs and concerns of stakeholders	Level 4: Future potential success Achieving enterprise objectives; best quality horizon as focus for improvement; investment as greater benefit
Efficiency	Level 1: Project management success Efficiency of project: internal efficiency in delivery within constraints; minimizing resources; procedural focus; project execution	Level 3: Business success Determining financial efficiency, business value and return on investment

Table 4: Efficiency/Effectiveness vs. Timing Orientation.

partial targets. It is primarily concerned with the task of project management. This is what most failure surveys assess and therefore where most failures are observed. Level 2 success is more deeply entwined with the technical activities resulting in the product or deliverables; indeed this is where quality provides the key to the assessment of success. Both levels can be said to be output driven as they look at the complementary aspects of technical action and management within established and imposed constraints. Level 2 success can extend to cover the entire operational life of the project output. After all, delivering a bridge which stands for one year before collapsing is far from being a mark of either quality or success.

The higher levels of success demarcate the shift from efficiency and output, to outcome and value as more strategic considerations come into play. Indeed while Levels 1 and 2 emphasise the output of the project, Levels 3 and 4 deal with the outcomes. The main distinction is that outputs occur as a result of a process as they are specified deliverables (that are delivered within time, cost and quality). Outcomes are the effects of change, and how it can deliver value for the entire business often beyond the scope of the original project. This relationship is depicted in the Table 3.

Encouraging long-term thinking is important from a strategic perspective. It also fits with the need to deal with extended life cycles and considers deployment, extended use and decommissioning of artefacts alongside benefiting from new opportunities and market possibilities. Moreover it also chimes with the idea of viewing software development as the development of a continuous service (implying long term relationships and strategic concerns) rather than the delivery of a single artefact. It is worth noting that, while Levels 1 and 2 are primarily concerned with the delivery of a single project, the remaining levels look beyond a single delivery view using a more strategic lens.

A further important distinction is the separation between efficiency and effectiveness. Project managers and software developers have shown a tendency to focus on efficiency and its implications, as is reflected by the obsession with failure studies. However quality solutions emerge from consideration of effectiveness. Efficiency is essentially viewed as productivity metric, as it is concerned with doing things right and by implication with following procedures and processes, adhering to constraints or achieving with minimum resources. Effectiveness on the other hand, deals with doing the right things and is therefore a quality metric; the ends to effectiveness' means. The relationship is depicted in Table 4.

6 Effectiveness: the Case for Quality

Failure studies and surveys seem to focus on criteria concerned with the efficiency of projects, while ignoring the effectiveness aspects, and thus sidestepping the major issues associated with quality. Indeed, many papers on quality seem concerned with the track record of projects as a measure of quality. However this is not the case as the triple constraints measures the ability to predict deadlines when uncertainty is highest and stick to them. This is not a measure of quality and is therefore addressed as Level 1 success. To attain project success one needs to relate to the quality aspects and perspectives related to the effectiveness of the project.

Contemporary understanding of quality implies moving away from the popular definition associated with high quality towards meeting the requirements that were specified for the project and that are essential for the users. It is now clear that quality is the main concern whenever we move beyond efficiency to consider effectiveness. The key to project success is being able to measure and indeed attain a sufficient quality level to ensure the project ultimately becomes a success. Project success requires consideration of the following [10]:

Quality of design introduces the concept of designers proactively deciding the level of quality that they consider is required. The level of quality therefore defines the characteristics specified by the designers, such as the type and grade of materials and their tolerances and the performance specifications.

Quality of conformance refers to the degree to which the design specifications are followed during manufacturing. Many other definitions of quality simply focus on **conformance to requirements**, which means that the project's processes and products meet the specified requirements.

Fitness for purpose means that a product can be used for the purpose it was intended. This is typically seen as being more rigorous than "fitness for use".

Quality and success are judged by different stakeholders in different ways, utilising different criteria, over different timescales [20][21][22]. Recently, there has been a tendency to let the customer define quality. The Kodak organization defines quality as "*those products or services that are perceived to meet or exceed the needs and expectations of the customer at a cost that represents outstanding value*" [23]. The interesting point to note with this definition is how the customer viewpoint impacts on a project: a project must take great care that it accurately defines customers' needs and expectations, and the ultimate power of deciding on quality is given to the customers. So with this definition, conformance to requirements is not necessarily sufficient – the customer must be satisfied with the resulting product or service. Further, in order to maintain the satisfaction of customers and their loyalty and to ensure higher level success, products need to be revised and adjusted to reflect shifting needs and expectations (as well as market trends and the competition). So maintaining quality becomes a continuous process of product (and process) improvement [10].

Over the years, several different views of quality have been employed, allowing project managers to select from a contingency of approaches and perspectives including the following:

- **Quality as a product-based quantity**: this is the traditional view of quality. The assumption is that quality is related to the content of the product
- **Quality as a user-based view**: quality is based on the values of the users. Such a view will therefore encompass the user's ideas through the notion of fitness for purpose and conformance to requirements. Initially this was viewed as a static value that had to be extracted prior to embarking on the process of development, but it is now understood to be an evolving set of values and preferences
- **Quality as a specification**: this view is derived from the manufacturing industries. The assumption is that a clear (technical) specification of the product exists or can be obtained. Quality can therefore be determined as conformance to this formal specification
- **Quality as a value-based approach**: the value-based perspective acts as a composite of the last two views. Quality is assumed to equate to what the user wants at an acceptable price and while conforming to an exact specification at an acceptable cost. Quality can thus be equated with value to the user (justified in terms of manufacturing costs)
- **Quality as a transcendent property**: quality can be equated with some kind of innate excellence. The exact parameters cannot be defined precisely. It is also difficult to impose tests to ascertain achievement since quality is felt rather than measured
- **Quality as a continuous property**: the modern approach views quality as the evolving satisfaction level of the users. The view is that change will force adjustments and that all aspects of the system, including quality, must be considered to be dynamic.

In general there appears to be an increasing emphasis on customer- and stakeholder- involvement which hopefully leads to project success. Modern project quality management emphasises the usefulness and acceptability of a product to its users. The satisfaction levels that the project solutions offer to clients and users are used as the measures for project success (Level 2 success). A further illustration of quality in the context of success is offered through the short case descriptions that follow.

7 Illustrative Examples

To highlight the distinctive features of the levels and the differences between them, it might be instructive to focus on thumbnail sketch examples from a range of sectors.

Story 1: The operation was successful but the patient died. Level 1 success—Level 2 failure

This paper described a number of failure surveys that focus on project management failure (i.e. the inability to meet time, cost and scope criteria). Project management success is no guarantee of project success as many targets are assigned arbitrarily at an early phase. For example, the third attempt to deliver a working ambulance despatch system for London was delivered by the agreed deadline (Level 1 success), but stopped working a few days later, resulting in potential loss of life [12]. In IT projects this is typical of a project delivered on time and within budget covering the agreed scope which is ultimately never used by the users.

Story 2: The Millennium Dome

The project to deliver a dome-shaped building to house a yearlong exhibition to celebrate the millennium had to be available in time for the new Millennium, the building itself and the infrastructure enabling Londoners to experience the exhibition were just about finished on time, but following an unexpected injection of additional funds. On opening night many of the exhibits were not functioning and dignitaries were left to queue outside for hours. Predicted visitor numbers exceeded one million per month but in practice about a third of the expected visitors turned up. The exhibition had to be kept open for a further year (in clear violation of the stated intention) to try and recoup some of the costs, while the entry fee was halved to attract visitors. Following the end of the exhibition the site was mothballed at a cost of £190,000 a year adding to the accumulated losses. However, once the sale was finally concluded, the renamed O2 centre became the biggest and most successful sports and entertainment arena in Europe. Level 4 success through innovative use of the structure thus managed to make up for the earlier short term disappointments (albeit in the hands of a new owner).

Story 3: The Sydney Opera House

An even more heralded failure which clearly failed in terms of Project Management, Project and Business. The Sydney Opera House came in at 14 times over budget, a clear project management failure. The building was unsuitable for its original purpose as the acoustics made it impossible to have concerts inside the building. However the building has become an icon and is considered to be an architectural marvel. It is attracting tourists from all over the world and generating revenue, not least for the entire city. The revenue is not generated under the original intention but the new potential has been utilized to the full. Interestingly, the building was not fit for purpose (and hence was not of acceptable quality), yet it managed to generate a new purpose – for which it was fit enough.

Story 4: Project Orion

A massive effort to develop Kodak's new Advantix photographic system was considered a big success on completion. The product was selected by Business Week as one of the best new products of 1996 (suggesting Project success). It also won the Project Management Institute International PMI Project of the Year award, making it a Project management success. The only problem was that Kodak failed to anticipate the accelerating switch to digital photography which made the product redundant. A successful output that won multiple awards was thus destined to become a failure as an outcome. In terms of quality the resulting product was an award winner but at the wrong end of the utilization and relevance curve, just as the technology slid out of fashion.

These brief vignettes highlight the complexity of success and the interplay between the different levels involved. Success is never simple, and the mini cases help shed further light on the rich, interconnected and intricate (and sometime temporary) nature of success.

8 Conclusion

Project failures have highlighted the need to improve IT software project practice. Many of the studies and surveys focus on project management success (or failure) which can be described as a sub-set of internal efficiency measures and imposed constraints ignoring the impact on the project and the business. In order to improve project performance we need to look beyond such measures and focus on project success, an area concerned with the effectiveness and quality of the project output. Success is a complex and multi-layered concept which needs to be understood at different levels and in different timeframes. Indeed, the impact of success often extends beyond a single project. This paper offers a wider perspective which takes in a range of project success levels, thus enabling practitioners to move beyond the simplistic measures that continue to be offered. The success view determines actions and colours new developments. Increased attention to enterprise objectives and quality, rather than simply endeavouring to optimize correctness according to imposed constraints, can open a new dialogue about the needs of a profession seeking to fundamentally and essentially improve its track record and enable development practices to rise beyond the continuous obsession with failure. In order to overcome failure we must learn to appreciate success, and grow enough to look beyond the simplest manifestations of an imperfect practice.

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