

**SOFTWARE PROJECTS SUCCESS: DEFINITION,
METRICS AND PERCEPTIONS OF PRACTITIONERS &
STAKEHOLDERS – AN EVALUATION**

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Abstract: *When a software project achieves success, it is certainly not because it did not go through problems, but mainly because these problems were overcome. Success is perceptual, and perceptions vary based on the practitioners and stakeholder's perspective, job, practices, organizational culture and goals. Practitioners and stakeholders' perceptions of project success vary in time, and are influenced by project politics, environment, technical and managerial considerations, client cooperation, and the service provider motivation and appreciation. Motivation is not only a paycheck as it, among others, include avoiding excessive use of rigid "Push and Follow", granting reasonable freedom for the practitioners, and taking good care of working conditions together with securing acceptable stress levels, and showing a horizon for professional growth.*

INTRODUCTION

Software projects are complex, deceptively easy to get disrupted with effects that may propagate explosively, and they achieve success, mainly because problems faced were overcome. "Software Success", is a core concept in software development process and its project management, for which it was the focus of the annual seminar & Symposium of the Project Management Institute (PMI) in 1986 [1]. A lot of research have been conducted, on different aspects of success, to find a consistent interpretation of the term, and to put in place an acceptable methodology to measure it [1, 2]. Business executives and CIOs, continue to perceive IT value primarily in terms of a simple ROI measurement, which neglects the shift to information and service economy [3]. Software projects outcomes, are often evaluated in terms of 'success' and 'failure' drawing on what is frequently called the 'PM triangle', which considers a project to be successful, when it completes "on time", "within budget", and "to specifications", within a reasonable tradeoff – a definition that satisfies only three basic criteria [4], which are inherently limited in scope, and sometimes drive projects to reach a challenged state.

Success is perceptual, and these constraints reflect outcomes that are considered to be important by only a subset of a software project participants, as perceptions vary based on the

practitioners and stakeholder's perspective. A common method of assessing outcomes, compares the final products with the predefined goals to conclude weather a project has been a success, or failure [5], but do these simple conclusions, pay due respect to complex processes such as software development? A popular definition of software success adds “customer satisfaction” to the iron triangle constraints [1, 6], but even with this important constraint, success and failure of software development projects continue to be a subject to heavy debates.

Information as the output of communication systems, can be measured at different problem levels, mainly: the technical level, the semantic level, and the effectiveness level [2]. Overcoming these problem levels leads to information transmission success.

Information Systems (IS), as the process of producing and transmitting information to the recipients, are similar to communication systems, and DeLone & McLean [2] published what became known as D&M model – a model derived from the Shannon–Weaver model and related Mason adaptation. It is a comprehensive taxonomy of Software Success comprising of six interdependent variables or components: “System Quality”, “Information Quality”, “Use”, “User Satisfaction”, “Individual Impact”, and “Organizational Impact” [2, 7]. Later, based on a researcher’s recommendation, they updated the model by adding a seventh variable – “Service Quality”:

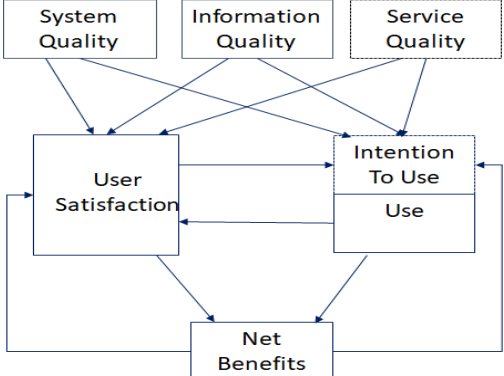


Fig. 1. User satisfaction and net benefits [7]

Bannerman [8] suggests an alternative model for software project success: the “Multilevel Project Success Framework”, which enables success to be determined at key milestones, at different times after project closeout, and from different stakeholder perspectives. Key milestones in this model (Fig. 2) relate to the project, the product, and the organizational benefits.

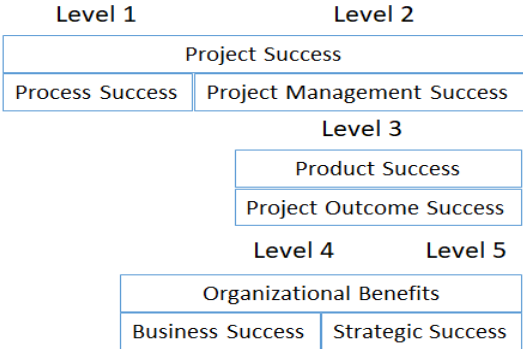


Fig. 2. Success Levels [8]

They represent five levels at which project-related performance can be formally or informally assessed and enable success to be determined and periodically re-determined as benefits accrue from the project over time. It also enables stakeholders to progressively map success to perceptions of higher derived value from the project as benefits accrue.

Many of the researchers see quality to have a significant positive effect on IT project success and a related study [9] concluded that 78.73% of project success, can be attributed to product quality, stakeholder acceptance, and organizational benefits.

SERVQUAL, a salient scale within the IS success literature, was first published in 1985 [10] to assess customer perceptions of service quality in service sector. To capture the extent to which a service meets customer's needs or expectations, it measures the quality of a service before and after its consumption [7].

“Software Success” can be divided in two main components: “Software Product Success”, and “Software Development Project Management Success” [1]. Although these components are distinctively separate, it is common to see them confusingly intertwined, and considered as single homogenous group in project management literature. Product success deals with the effects of project's final product (goal/purpose), while project success deals with inputs / outputs, and focuses on the project process, in particular, successful accomplishment of cost, time, and quality.

In contrast to common belief, ‘failure’ does not mean that a system is ‘falling apart’ or needs to be altogether abandoned, but is simply not used in the way intended [11], and some successful software products were an output of a challenged (or even a failed) software development project management, as they were not produced neither on time nor within budget – one project that ran over the financial budget by 417% and over the approved schedule by 193% was deemed the most successful project of all by IS professionals [6].

1. CUSTOMER EXPERIENCE AND METRICS

“Customers are the lifeblood of every organization and the money they spend is the oxygen that enables the business to exist, grow, and thrive” [12]. Near history literature has not considered “Customer Experience” (CX) as a separate construct, and instead, researchers have focused on measuring customer satisfaction and service quality [13]. The CX concept was first touched by Holbrook & Hirschman [14], who referred to it as “consumption experience”. In the 1990s Pine & Gilmore [15] popularized the expression CX in literature, and by the 2000s, the concept evolved to include the interactions between customer and product (or service) as a significant element for creating an experience [16]. Interest in CX measures is increasing steadily and executive management at companies of all sizes and across all industries see the strategic significance of superior Customer Experience (CX) [13, 17]. Meeting needs is not anymore enough to deliver effective, easy, enjoyable customer experiences, and firms are adopting a new experience architecture and philosophy to overcome experience gaps in performance, convenience, personalization, and trust.

CX, with its cognitive, emotional, physical, sensorial, and social elements [18], is the overall perception a customer has of software systems products and services (and a brand as a whole), throughout their end-to-end customer journey from marketing, to sales, to serving their needs for superior service, value, and growth [19]. Resolving a single software product technical incident, a bug, or performing an individual upgrade of a software product can only serve as a touchpoint in the software systems customer journey, where the whole experience, the sum of all the touchpoints, with the delivered software system is what really matters to drive stronger (or weaker) business outcomes. The power of predicting and shaping CX can help an organization to improve or at least maintain its position in the market [19].

Customer Experience Management (CEM or CXM), the science of knowing own customers as completely as possible [20], and making interactions with them friendlier, easier, and more convenient [15], aims to create growth (increase revenue from existing and new customers) via granting great experiences and guaranteeing positive word of mouth to strengthen brand preference [13]. It aims also to lower costs by reducing customers' fluctuation, improving customers' loyalty and creating advocates through valued and

memorable customer interactions [20]. “Customer satisfaction” in software systems is a measure of how well the products and services meet or miss customer expectations. Customers expect the very best, and if they do not receive it, they’re happy to look elsewhere, and while customer expectations are rising faster than companies’ efforts to meet them, companies around the globe are embracing the concept of CXM and incorporating the notion into their mission statements [13]. A customer experience program targets to gather customer experience intelligence, uncover customer insights (from data), and take action to close the loop and improve customer experiences through customer experience design [21].

Being an emotion and a human experience, satisfaction is difficult to measure, for which, organizations turn to “Customer Intelligence”, the key to understand the “who, what, when, and where” of customer behavior, using its quantitative data from customer analytics, and its qualitative data from customer feedback [21]. Customer Analytics collects data, through metrics like “Churn Rate” (the rate at which customers flee out of doing business with an organization); the “Retention Rate” (the percentage of customers that remain loyal over a given period of time); and the “Customer Lifetime Value (CLV)” (the measurement of a customer’s total revenue value to a company over the lifespan of the relationship).

Customer Experience Metrics help to understand a team’s ability to meet end-user expectations and how it correlates with brand perception, and their comfort when interacting with it. Popular direct Customer Experience Metrics include: the Customer Satisfaction Score (CSAT), which measures the customer’s subjective assessment of efforts; the Net Promoter Score (NPS), measuring the consumers’ readiness to refer a company to others; the Customer Effort Score (CES), which measures the ease with which customers can get/use a product/service, resolve a support issue, or find the information they need; and Customer Service Satisfaction (CSS) measures how satisfied customers are with an after-sales service [21].

Popular Indirect Customer Experience Metrics, among others, include the Customer Health Score (CHS), or Churn Score: a popular metric in software as a service (SaaS), to assess the health of relationship with a customer. It looks at the customer behavior patterns over time, and measures how at risk of churning. It is influenced by customer related factors like product & license type, Amount of money spent, Product usage period, Number of interactions with the service team, willingness to answer surveys, etc. The metric doesn't have a set formula, and accurately calculating it depends on the particular product.

Despite CX’s fame, many argue that proxy measurements of CX (such as service quality, customer satisfaction, or the Net-Promoter-Score), with very little or no link to consumer behavior, cannot demonstrate CX’s crucial link to a firm performance, and suggest the use of more comprehensive measurements built to understand the CX as main driver of consumer behavior, such as: Customer Experience Quality (EXQ), and the Wallet-Allocation-Rule (WAR), [22]. In software systems, frequently used metrics include the productivity metrics (such as the tickets volume, resolution rate, first contact resolution, etc.), the performance metrics (such as average resolution time, first response, average response times, etc.), the business metrics (such as retention rate, churn rate and Customer lifetime value (CLV)), and customer service and support metrics.

2. PERCEPTIONS OF PRACTITIONERS AND STAKEHOLDERS

Perception is a powerful tool that influences the problem-solving abilities, and when having a "broad and inclusive perspective", practitioners are more likely to find creative solutions compared to those having “narrow or rigid perspective”. As such, perception is a key success determinant for the software developer, software development, and process outcomes.

Perception in software development can be either based on a Strategic perspective that summarizes the views of business-oriented stakeholders in an organization, such as the top

managers, business analysts, and market experts (who are interested mainly in revenue and customers); or based on a Tactical Perspective, which represents the views of stakeholders responsible for the daily management of the software development process.

To have a better understanding of how practitioners and stakeholders perceive software project success, how specific factors influence the project outcome, and how all of this relate to traditional measures of meeting user requirements, we reviewed some of the published empirical studies and shortlisted components of projects outcome, with high influence.

Different software project participants perceive success criteria differently [23]. The definition of ‘success’ as the viewpoint of various project stakeholders differ based on a stakeholder job, practices, organizational culture and goals [4, 24], and without a common understanding of measures, there can be no achievement of a common goal [24]. In Procaccino et al. [4] practitioners considered a software project to be successful if it produces an easy-to-use product that meets customer needs and grants an internally motivating software development work.

Practitioner motivation is reported to have the single largest impact on practitioner productivity [4], and should be considered when developing project requirements, forming teams, and assigning tasks. Professionals are motivated by interesting work, challenge, and increasing responsibility – intrinsic factors that answer people’s deep-seated need for growth & achievement and activate their own internal generators [25]. While Practitioners understand and respect the need to meet customer requirements [6], they may find value in knowledge gained even in an expensive project, which was cancelled (something on which customers and software project management will not agree on [6, 24].

The subject of success and failure perceptions in software projects didn’t get much attention from researchers till lately. Studies, and publications, covering the topic are scarce, and hardly found. In 2005, *Procaccino, Verner, Shelfer* and *Gefen* published their study on practitioner perspective for project success, in which they reviewed several empirical studies [4, 6, 25, 26], and surveyed 66 software development practitioners. In their analysis, they reviewed the software development process and its outcomes, and categorized aspects both of the process and its outcomes as either personal/professional or project [4]. According to the study, Personal/Professional (from the perspective of the practitioner) aspects, include the extrinsic (external) aspects, such as monetary compensation and office ergonomics, and the intrinsic (internal) aspects, with high impact on motivation, such as the freedom to work creatively. [6, 27]. On the other hand, project aspects include the project process and project outcome related items – the first is associated with the development team, customer and requirements management, while the second is traditional for the organization or managerial criteria, such as schedule estimation, meeting budget, customer requirements and system’s ease of use [4].

In the combined view of Process/Project and Process/Personal items as in Table 1, the highest 16 items were process/project-related, which highlights the importance developers put on the characteristics of, and interactions with, the rest of the development team, and shows the importance of equipping projects with properly skilled teams, to handle acceptable, achievable, and realistic software project requirements in accordance to available time, talent, and technology.

Table 1. Combined view of ranked importance of process/project & personal related items

Rank	Item	Agree
1 Process/Project	Customer/users provide developers with feedback	94.3%
2 Process/Project	Team is skilled	91.4%
3 Process/Project	Requirements are accepted by the development team	91.4%
4 Process/Project	Project manager provides feedback	91.4%

5 Process/Project	Customer/users have realistic expectations	89.3%
6 Process/Project	Defined methodology	88.6%
7 Process/Project	Team included in decision-making	88.6%
8 Process/Project	Requirements are clear and understood	88.6%
9 Process/Project	Requirements can be clarified	85.7%
10 Process/Project	Customer/users and developers have good relationship	85.7%
11 Process/Project	Team turnover is low	82.8%
12 Process/Project	Project has well-defined scope	82.8%
13 Process/Project	High level of customer/users involvement	82.9%
14 Process/Project	Negotiate changes	82.1%
15 Process/Project	Enjoyed working with team	80.3%
16 Process/Project	Provided with enough freedom	80.3%

When looking at the combined results of the outcome related items, as in Table 2, an even split between outcome/personal and outcome/project items can be noticed, which shows that practitioners not only value intrinsically related items, such as doing a good job, having a sense of achievement, having satisfying work that results in professional growth and learning something new, but also place importance on meeting customer needs with “an easy to use product”.

Table 2. Combined view of ranked importance of outcome/personal project related items

Rank	Item	Agree
1 outcome/personal	Do a good job (i.e., delivered quality)	95.4%
2 outcome/personal	Sense of achievement	95.5%
4 outcome/project	Product easy to use	87.8%
5 outcome/project	Meets customer/users requirements	84.8%
6 outcome/project	Accurate estimation of time	78.6%
7 outcome/personal	Working on project is satisfying	77.3%
8 outcome/personal	Results in professional growth	77.3%

Procaccino et al. [4] study findings show how practitioners consider software projects to be successful, when they provide intrinsic, internally motivating work to develop easy to use software systems that meet customer/user needs.

3. PROJECTS FROM PROFESSIONAL BACKGROUND OF AUTHORS

Success perceptions are usually constructed through a continuous process of sense-making and heavy negotiations. To show how information systems project outcomes interpretation, and success perceptions not only vary, but also evolve throughout the project development life cycle, and later during its life operation, we describe briefly two project cases from the first author professional background working at both a client and a service provider side. These project cases are not provided as complete studies, they are personal impressions related to various perceptions of projects success.

3.1. Project Case I

At a governmental institution, in the early 90-ies, the first author was partially responsible for an ambitious multimillion project, for an in-house development of financial, and operations applications built using Oracle databases & development platforms; and running on multiple redundant clustered RISC based UNIX servers; to serve large, medium and small sites and users through CISCO, 3COM, and US Robotics LAN/WAN and dialup networking infrastructure via multiple E1's and tens of dialup communication lines. The project included an ambitious training program and was supposed to finish in 4 years, but due

to hardware, software, and networking complexity for that time, the training program went slow and experienced delays, which impacted heavily the software development process, already suffering delays due to professionals outsourcing, and skills replacement. Throughout its development lifecycle, the project, experienced additional delays, caused by communications lines availability and outsourcing procedures, upgrading systems and application, computing and networking requirements outsourcing, budget availability and release, top management changes, etc. In total, all these problems and obstacles accounted for more than 50% of the additional project duration – with two out of six planned applications rescheduled for a new project. The project produced “easy to use” software systems that fully answer institution needs and strategy (despite all the problems faced in the development process). The type of institution owning the project (governmental), and the type of development process used (in-house), had a great impact in helping the project to deliver and to be considered, against all odds, as “successful”.

Perceptions of project players

If we apply the iron triangle criteria, we can say: “the project managed to deliver products to the specifications and to the satisfaction of the customer but missed heavily in budget and time” (provided that we omit reduction in scope). Practitioners’ perceptions in general were positive and considered the project a big success. They considered the original plans very optimistic and inaccurate. Using the project aspects categorization suggested by Procaccino et al. [4] discussed earlier, the top aspects per category with the greatest importance in forming practitioners’ perceptions for project success, were:

- **Process Project and Personal:** Development teams were divided into small and skilled development groups, financial and operations departments had realistic expectations, requirements details were easily clarified, changes negotiable, and relations with the departments’ managers and end users were good. Practitioners enjoyed working on the project and were in a position to learn new things, use a lot of new technical tools, and thus increase their value in the professional market.
- **Outcome Project and Personal:** Requirements were met, the customer was happy with the end product, slipping on time and budget was not considered as a major issue. The new skills, and experience earned by practitioners, compensated a little for the low paycheck, and will help in future professional and financial growth.
- **Project Manager Perceptions:** objectives reached successfully, took longer than planned. The institution is happy with the results achieved, and project participants gave their best to answer needs and strategy.
- **Top Management Perceptions:** Although took a long time, the project is a success, and the efforts of all participants are appreciated.
- **Users Perceptions:** In comparison with legacy applications, systems are easier to use and help in doing the required tasks.

3.2. Project Case II

In the early 2000s, while managing a regional office, the first author, for some time, stepped in the role of a project manager, of a fixed cost project for building a mobile and back-office applications with online transactions transmission and databases synchronization. The customer required the whole development to be onsite, and all related professionals to be cross-country relocated, with planned solution rollout in one year. It was when Windows CE on Personal Device Assistant (PDA), had their first steps in online data transmission using mobile GPRS communication protocol. As the project started, everything went as planned, and a comprehensive system definition document was produced, submitted, and expected the customer project manager approval to proceed. A milestone, which was followed by heavy uncompensated extra costs caused by undetermined customer project manager (and his

superiors) who justified delays in giving the document approval and demanded to go on with system analysis, to avoid unnecessary delays, as the project is urgent, and the approval is just a formality that needs time. The company top management on the other hand, and in order to utilize resources already on the ground, agreed hoping to stay within budget and on schedule. After three months from the project start, and without the definition document approval, development process went through a series of pumps, due delays caused by customer project manager and the company top management decision to transfer most experienced and backbone developers to another prioritized project. As a result, other developers lost faith in a good project fate, and started to flee out. The project, nine months after its start, achieved not more than 25% of the requirements, as was left mainly with junior practitioners. Suddenly, a corrective process was triggered, which helped the project to finish and succeed – the customer decided, under the influence of division manager owning project, to replace his project manager, and the company responded by assigning new capable project managers at both sides, and several talented senior developers were added to the development team. The solution was rolled out six months later than scheduled.

It can be said that the project outcome answered the client needs, although the software project development process went through a turbulent and costly path. The customer, having the free hand to pick and choose, correct, fix, and change in most of the project time with no change management control in place got a system, very rich in capabilities, and was satisfied. The final software solution was one of the first of its kind in the Middle Eastern market with its technology and functionality, and had a promising future that needed some shaping to guarantee its market share, something the service provider top management didn't pursue, as they considered the project a bad experience. In the following years the customer had additional modules and capabilities developed (by other companies) making very good use of the modular system delivered.

Perceptions of project players

According to the iron triangle criteria, the project managed to deliver a successful software development outcome but failed to stay within budget and schedule. Below, we use categorization suggested by Procaccino et al. [4] to describe practitioner's and project manager's perceptions:

- **Process Project and Personal Aspects, and related Perceptions:** At the beginning, practitioners were convinced with their capabilities, were happy with the experience, enjoyed working in the team, and considered the overall working conditions as good. They experienced customer cooperation, requirements specifications were accurately collected, and processes well documented. In the middle of the project, as relations with client project manager went on bad track, change control management process disabled, the customer requirements evolved, and the company top management behavior favored abandoning the project, practitioners became convinced that the project is on its way to fail and work conditions were unbearable. Some Practitioners lost focus, and considered that the skills, knowledge, and experience they were looking to achieve, do not deserve the stress they were subjected to. When the client project manager was replaced, and the change management control was reinstated, the project scope at last got frozen, the practitioners restored their faith in their capabilities and were convinced that the project will get lucky and succeed.
- **Outcome Project and Personal Aspects and related Perceptions:** When the solution was rolled out, and stakeholders satisfied, practitioners took a deep breath and were happy, and although learned a lot and gained skills highly appreciated by the market, none of them wanted to go through such an experience again. Practitioners considered that the project missed budget and duration not only because of a bad experience with the

customer, but also because of inaccurate estimates by the sales team, and top management.

- Client Management/users Perceptions: Appreciated solution outcome that was easy to use, rich in functionality and answered all requirements.

4. CONCLUSIONS

Process related perceptions are not constant, they vary with time and are heavily influenced by changing project politics, environment, client cooperation, organizational motivation, etc. Although important, motivation is not only a pay check at the end of the month, but also a methodology to ease practitioners stress and improve working environment, that said, slipping in projects on budget and schedule, cannot always be solved at the expense of software development practitioners. Avoiding excessive use of “Push and Follow”, granting reasonable practitioners freedom, and taking good care of working conditions, together with maintaining acceptable stress levels, reasonable appreciation, and a horizon for professional growth are all – among others- necessary to create a pleasant, two way fruitful project experience.

Internal politics, at both of the customer and organization sides, can impact heavily the chances of a project success. Subjecting project managers continuously to heavy stress to prove skills, cost effectiveness, and loyalty, comes at the expense of good project flow, and gets amplified by internal politics, competition and ropes pulling among departments.

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ОЦЕНКА НА УСПЕХА НА СОФТУЕРНИТЕ ПРОЕКТИ: ОПРЕДЕЛЯНЕ, МЕТРИКА И ВЪЗПРИЯТИЯ НА ПРАКТИКУВАЩИТЕ И ЗАИНТЕРЕСОВАНИТЕ СТРАНИ

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***Ключови думи:** Възприятия на заинтересованите страни, успех на софтуерни проекти, KPI, проучване на клиентите,*

***Резюме:** Когато един софтуерен проект постигне успех, това със сигурност не е защото не е преминал през проблеми, а главно защото тези проблеми са били преодоляни. Успехът е възприятие и възприятията варират в зависимост от гледната точка на практикуващите и заинтересованите страни, работата, практиките, организационната култура и целите. Възприятията на практиките и заинтересованите страни за успеха на проекта варират във времето и се влияят от политиката на проекта, околната среда, техническите и управленски съображения, сътрудничеството с клиентите и мотивацията и оценката на доставчика на услуги. Мотивацията не се състои само в заплатата, тъй като тя, наред с другото, включва и избягване на притискането и непрекъснатото „преследване“, предоставяне на разумна свобода на практикуващите и полагане на добри грижи за условията на труд, заедно с осигуряване на приемливи нива на стрес и демонстриране на перспективи за професионално израстване.*