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Measuring project success: conceptualizing a new approach applicable to all project types

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Abstract:

There is much confusion about what constitutes a successful project, since often the criteria applied are not made clear at the outset and the boundaries for what is to be included in the evaluation become blurred. To overcome this problem, a new approach (called *i3d3*) is conceptualized for measuring project success based on the objectives of multiple stakeholder groups, and conducted at multiple assessment points in time. It also enables a method for comparing success between projects regardless of type, size or location so that differential performance outcomes across a portfolio of projects become manifest. It is concluded that there are generic criteria applicable to any project type, although the detail of the evaluation may require specific customization to capture the pertinent characteristics involved. A single score can be computed to identify success and to rank projects on a common scale. This paper sets out the framework for achieving such an outcome and establishes the foundation for future tool development and testing.

Keywords:

project success factors, benefit realization, collective utility, stakeholder satisfaction, multiple criteria decision-making

1 Introduction

Measuring the success of completed projects has always been a perplexing challenge. The traditional view of project success is associated with time, cost and quality objectives (Carvalho *et al.*, 2015). This view comes from Martin Barnes's 'iron triangle' consisting of the core project constraints that he introduced in 1969, in which a project is considered successful when the actual cost and time are very close to the initial planned budget and schedule, and all deliverables meet the requirements agreed by all stakeholders involved in the project (Langston, 2013; Berssaneti and Carvalho, 2015). However, due to changes in the global business environment and market demand, these criteria are seen by some as too simple to deal with the requirements of project stakeholders (Toor and Ogunlana, 2009; Alzahrani and Emsley, 2013).

Is it possible to compare the success of a doghouse and an opera house, or a new aircraft with a refurbished apartment building, or a telecommunications tower with relocating an organization to bigger premises across town? All of these things are projects and all of them have the objective of being successful interventions that realize benefits to stakeholders within society. These benefits are not necessarily financial, but may provide social, political or environmental advantage. How do we know what represents the best use of our time and resources in terms of creating collective utility to those affected by our actions?

The aim in this paper is to propose a framework for measuring project success that is agnostic to type, size or location. So theoretically we should be able to compare a doghouse with an opera house, for example, even though the former is small, inexpensive and could be finished over a weekend, while the latter is large, expensive and may take a decade to complete. The collective utility of the doghouse might lie with its owner (the dog), while the collective utility of the opera house might give pleasure to a large cross-section of the community.

Recent research by Albert *et al.* (2017) provides a good starting point. They undertook a structured literature review on the topic of the evaluation of project success. They examined similarities in the assessment of project success in different fields of application, and claimed this was the first review of its kind despite project success being a widely scrutinized topic in project management research. Based on six different fields of application, they extracted characteristic project success criteria. They based their work on the assumption that project success included project management success, product success and performance over time. What they discovered was a world of inconsistency. Their key conclusion was that "a generic model to describe project success should be developed to provide a common guideline for assessing" (Albert *et al.*, 2017:18).

2 Literature Review

Numerous researchers have proposed diverse types of models to develop a more robust approach to understand project success and what criteria are reliable enough to be used during such deliberations. Some of these studies have been conducted based on the perceptions of different stakeholders involved in the project such as clients, project managers, investors, project team, community and so forth. For some researchers, success is a subjective phenomenon, and is dependent on the perspective of those who are measuring it, because intangible criteria mean different things to different people. Müller and Turner (2007) found that project managers themselves are possibly the most influential variable for project success realization. Each industry or organisation, project manager or team, potentially can form their own definition of success (Chan and Chan, 2004; Jha and Iyer, 2006; Berssaneti and Carvalho, 2015).

For instance, Frödell *et al.* (2008) investigated project success from the construction client's perspective, and their findings showed that factors such as user's participation, commitment to the project, high standard of quality consideration among the construction workforce and team working are of significance in achieving success. Savolainen *et al.* (2012) considered project success and failure from the supplier's perspective. They found that the criteria for software development success from the supplier's perspective can be summarized as: (1) customer satisfaction, (2) short-term business success for the supplier, and (3) long-term business success for the supplier. Yamin and Sim (2016) examined the success of international development projects from the local project team's perspective and found that monitoring, coordination, design, training and institutional environment have a significant relationship with project success. Davis (2017) proposed a new multiple stakeholder model that takes into account all stakeholders' opinions in judging project success and recognising its principal dimensions.

Radujković and Sjekavica (2017) argued that project success differs from project management success. Their study gave definitions of project management success and reviewed different models of quantification. Although success criteria may vary from

one project to another, Langston (2013) introduced a model using six generic key performance indicators (KPIs) that can be measured objectively as ratios of the core constraints that he described as scope, cost, time and risk to enable comparison of projects in terms of delivery success regardless of type, industry, size or time. Carvalho and Rabechini (2017) proposed a project sustainability management research model and verified its positive impact on project success dimensions, although the magnitude of this effect was shown to be moderate. Berssaneti and Carvalho (2015) defined the key variables that impact project success. In their research, time, cost and technical performance are deemed as the core dimensions of project success and they found that project management maturity is significantly related to these factors. Cheng *et al.* (2010) proposed a more scientific approach based on artificial intelligence to evaluate project success by employing a fast, messy genetic algorithm, a support vector machine and K-means clustering.

In a construction context, extensive studies have emphasised the importance of identifying critical success factors (CSFs) for measuring success (Cooke-Davies, 2002; Fortune and White, 2006; Alias *et al.* 2014). Alzahrani and Emsley (2013) studied project success by focusing on the effect of contractor's attributes from a post-construction evaluation perspective. They identified a number of CSFs such as turnover history, quality policy, adequacy of labour and plant resources, waste disposal, size of past projects completed and company image as the most significant factors affecting project success. Yong and Mustaffa (2012) recognized the significance of human-related factors such as competence, commitment, communication and cooperation towards the success of a construction project. Toor and Ogulana (2009) stated that factors related to project planning and control, project personnel and client involvement were critical for the success of large-scale construction projects from the construction professional's perspective. Most of these studies have adopted research approaches that first extracted sets of success factors based on reviews of relevant literature and project characteristics, and then validated them quantitatively or qualitatively through questionnaire surveys (Yu and Kwon, 2011). However, a crucial limitation is that it is difficult to prioritize, categorize and reduce the factors to a more manageable number. Hence, a compelling model encompassing all CSFs has yet to be developed (Mir and Pinnington 2014; Stefanovic, 2008) and indeed may be impossible.

Project success is intricately interwoven with project performance, and a countless number of studies have used KPIs to measure this factor to evaluate project success. Chan and Chan (2004) developed a set of KPIs comprising time, cost, quality, functionality, user expectations and satisfaction, measured both quantitatively and qualitatively, by undertaking a comprehensive review of the literature, and then verified the practicality and usefulness of these KPIs using case studies. Ofori-Kuragu *et al.* (2016) offered nine KPIs for Ghanaian contractors to measure project performance towards success. These KPIs in order of relevance were quality, client satisfaction, cost, time, business performance, health and safety, environment, productivity and people. For Mphahlele (2015), overall stakeholder satisfaction, cost, time and quality turned out to be important KPIs for measuring project performance on innovative building technology projects. Mir and Pinnington (2014) recommended that project management itself was the most significant individual variable contributing towards the success of any project. They concluded that performance measurement is essential for organisations to enhance project success.

Achieving project success goes beyond delivering the project to the satisfaction of the client (Williams *et al.*, 2015). This implies that a successful project has to be acceptable to a wide range of stakeholders, including the owners or sponsors, regulatory

authorities, project developers and end-users. As such, project success involves the integration of stakeholder needs from the beginning to the end of the project (Heravi *et al.*, 2015). According to Davis (2014; 2017), different stakeholders have different perceptions and factors of project success. The result of her research indicated that "*all stakeholders do not value all dimensions of equal importance to achieve project success and therefore, relevant dimensions varied between stakeholder groups with different perspectives in the literature*" (Davis, 2017:615). The requirements for each stakeholder group needs to gathered together and put into consideration in ensuring that the right project is done right to deliver its stated objectives (Kerzner, 2017).

Time is a significant criterion when gathering information and when making informed opinions about any project. Turner and Zolin (2012) developed a model of predicting performance indicators for managers to study the perception of success by stakeholders. They showed that the perception of success does change over time. From this they concluded that to gain an understanding of how to achieve a successful project, one must integrate the opinions of various stakeholder groups over multiple time frames.

3 Proposed Conceptual Framework

The literature demonstrates there is much controversy about what makes a successful project and who should be the judge. Do all projects share potentially common criteria, or is every project different? When should the success of a project be determined and is it even measurable at all? What are the critical success factors that lead to favourable outcomes?

To explore these questions, it is first necessary to consider a project to be broader than the typical definition used by project managers who view the end of a project as being when it enters its operational (post-delivery) phase. Otherwise, project success is framed by the design and delivery processes that were involved in its creation, and fails to consider the impact of the project once it is handed over to the project sponsor or client. Impact is not just financial return, but should include social, political and environmental consequences as well. At any rate, clearly time is critical to gather information and make informed opinions about project impacts.

The key to success is measuring benefit realization. Benefits are both tangible and intangible, and in the latter case, they can be resistant to objective measurement. They must also be viewed as societal, which means that although some stakeholders may win and others lose, successful projects provide positive collective utility to society. This cannot be determined at the point a project is available for its intended use. A period of evaluation time is necessary during the post-delivery phase. For example, in the case of built assets, this is commonly referred to as post-occupancy evaluation.

Time, therefore, plays a fundamental role in measuring project success. There are three generic phases that underpin the life of all projects: pre-delivery, delivery, and post-delivery. Although there is a range of labels used in different contexts, they share a common sequence of (1) develop/plan, (2) execute/control and (3) operate/utilize. End of life is part of post-delivery. We don't need to wait until then before we can finalize our judgment about a project's success, because if we did, then the verdict will have little interest to any of its former stakeholders.

During each phase, different sets of stakeholders have higher power and interest towards evaluation of project success. Different criteria apply too. For a project to be successful, it must do so across all three phases. Often design-related criteria (such as

functionality, beauty, etc.) are mixed with delivery-related criteria (such as on time, within budget, etc.), making it difficult to know whether the designer did a good job or the project manager did a good job. Even where success in both these areas is clear, what do the project recipients (such as end-users or customers) think? Any measure of success must surely take account of how successful projects are at realizing their initial vision for the target audience.

All of these ideas and considerations have led to a proposed new framework for measuring project success. Its key characteristics are that it has three time phases, different sets of primary stakeholders (who perform the evaluation of success), different criteria per phase that ideally should be generic across all project types, different methods of evaluation per phase, and an overarching focus on measuring benefit realization that leads to positive collective utility. The proposed framework, known as *i3d3*, is shown in Figure 1. Its title references the three generic phases (renamed as initiate, implement and influence) and the three generic objectives of these phases (design, deliver and delight). It should be noted that stakeholder communication across each phase is critical to ensure that common purpose and vision is maintained. Project success is simply characterized, with the wisdom of hindsight, as 'doing the right project right'.

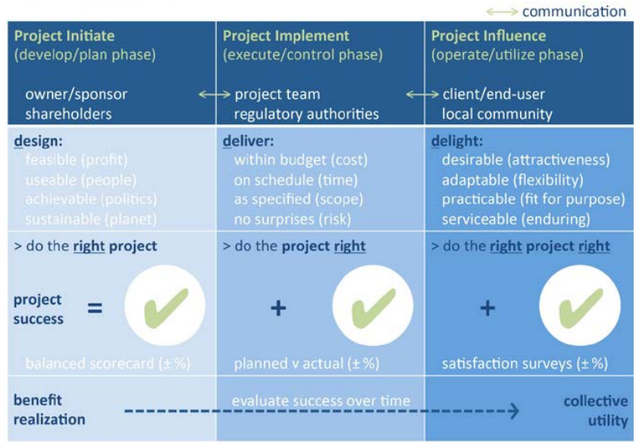

Figure 1. Proposed *i3d3* framework

Each phase of the proposed framework will now be explored in further detail.

3.1 Project Initiate

The key stakeholders in this phase are owner/sponsor and shareholders. Their focus concerns creating a design that will maximise the potential benefits. Success factors can be viewed as a quadruple-bottom-line evaluation to determine if the project is feasible, useable, achievable and sustainable (in that order). The objective here is to do the right project. A balanced scorecard approach can be used to evaluate success on a fixed scale (-100 to +100).

A successful project should be feasible. Its intended cash flow should be positive (benefit-cost ratio should be greater than 1). It may involve a trade-off between short-term expenditure and long-term income, and therefore needs to forecast future economic conditions that the project must negotiate. Even projects that do not seek to make a

financial return usually need to consider financing sources or sponsorship to get them off the ground.

Feasibility is important, but only if projects are useable. Design solutions should add value, such as improving our standard of living or making people safer or more productive. Projects should have purpose. While not all projects can contribute high-level social outcomes, they must at least demonstrate local community support. Successful design is not a top-down process, but must engage and consult with the people it is designed to serve.

Making a valid contribution to society is noble, but it must also be achievable. This is a political imperative and is often a mix of risk (negative consequences) and reward (positive consequences). A risk management approach is well suited to dealing with the uncertainty of future actions, and is typically a function of probability of occurrence and the impact of any consequences should they eventuate. The risk attitude of the key stakeholders will always be a consideration.

Once the project's risk and reward profile has been accepted, it then needs to be determined if the impact of the project on its surroundings is sustainable. Few projects are truly sustainable within a broad system boundary. However, once again a trade-off is needed, in this case between progress and conservation. If the ecological footprint of the project is within acceptable limits, then the design process is complete and detailed documentation of the project can be finalized.

Figure 2 highlights there is a sequence during the design process to ensure overall success can be achieved without exploring solutions that ultimately do not meet stakeholder expectations. Each success factor is treated like a compliance 'gate' before proceeding further, although ultimately there is a trade-off between factors to ensure that all meet minimum expectations (e.g. financial return is reduced to help minimize environmental damage).

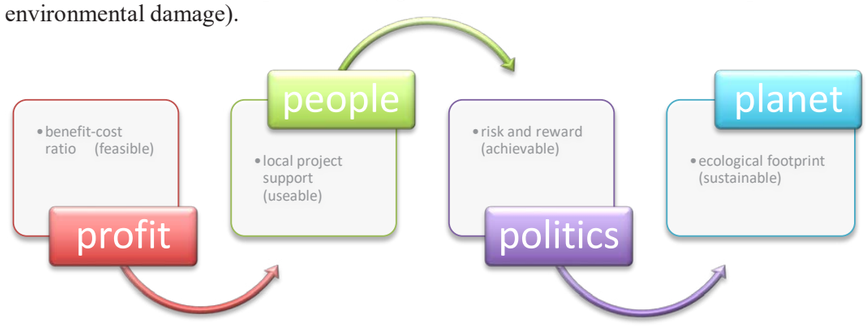

Figure 2. 4P design process – adapted from Beech (2013)

A balanced scorecard approach is used to perform the various trade-offs necessary to get a well-designed project. There is usually no optimum or perfect solution, as maximizing one success factor might put downward pressure on others. The objective is to get the highest overall score within the identified constraints and ensuring that this score is positive (i.e. the project is progressive, not regressive).

3.2 Project Implement

The key stakeholders in this phase are project team and regulatory authorities. They form an important communication bridge between 'owners' and 'users'. Their focus concerns the best method to deliver the project. Success factors can be viewed as an

assessment of being within budget, on schedule, as specified and with no surprises using six KPIs as defined by Langston (2013). The objective is to do the project right. A comparison of planned versus actual performance can evaluate success on a fixed scale (-100 to +100).

The six KPIs embedded in Langston's 3D Integration Model, applicable to the assessment of any project regardless of type, size or location, comprise:

1. *Value*. This is defined as the ratio of scope over cost, assessed in the context of stakeholder management. It should be maximized.
2. *Efficiency*. This is defined as the ratio of cost over time, assessed in the context of resource management. It should be maximized.
3. *Speed*. This is defined as the ratio of scope over time, assessed in the context of procurement management. It should be maximized.
4. *Innovation*. This is defined as the ratio of risk over cost, assessed in the context of communications management. It should be maximized.
5. *Complication*. This is defined as the ratio of risk over time, assessed in the context of quality management. It should be minimized.
6. *Impact*. This is defined as the ratio of risk over scope, assessed in the context of environmental management. It should be minimized.

It is not possible to optimize all KPIs. The equation for determining the best mix of success factor performance is given by Equation 1 (Langston, 2013). Project delivery success (PDS) is calculated for both planned and actual performance, and the percentage change between them is computed after delivery has been completed. High positive changes between planned and actual PDS are preferred.

$$PDS = \frac{scope^3}{cost \cdot time \cdot risk} \quad \text{(Equation 1)}$$

where:

scope = *a measure of the size or extent of the project*
cost = *the cost of implementing the project*
time = *the duration (e.g. working days) for implementing the project*
risk = *the mean risk level (probability x impact) of all risk events*

From a delivery perspective, basically projects that deliver more scope for less cost, time and risk are considered successful. This may occur regardless of the merits of the design itself. The measurement of PDS is based on the PMBOK® Guide (PMI, 2017). The link between project management knowledge areas and generic KPIs is illustrated in Figure 3. The model underpinning PDS takes the form of a tetrahedron, where the vertices, edges and faces all have meaning (Ghanbaripour *et al.*, 2017).

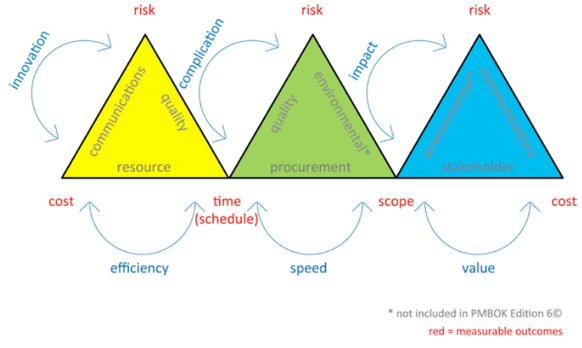

Figure 3. 3D integration model (Langston, 2013)

3.3 Project Influence

The key stakeholders in this phase are client/end-user and local community. Their focus concerns ensuring that the project fully realizes the designed objectives and leads to satisfaction (or delight). Success factors can be viewed as whether the outcome is desirable, adaptable, practicable and serviceable. These qualities are considered to be generic across project types. The objective here is to do the right project right. An opinion-based 5-point Likert survey of stakeholder satisfaction can be used to evaluate success on a fixed scale (-100 to +100).

For each of the four generic success factors, ten customized (context-specific) questions are required to collect satisfaction feedback. Provided a reasonable period of time has elapsed since the beginning of the final phase, respondents should be able to provide meaningful insight into the performance of the project from either a client/end-user or community perspective. Table 1 describes the opinion scale for each question (-2 to +2). Table 2 describes the relevance scale for each question (1 to 5). Opinion and relevance are multiplied together to obtain a weighted satisfaction score between -10 and +10. Across all questions pertaining to each success factor, and across all respondents to the questionnaire, a positive mean score is good. A high score suggests a strong level of satisfaction with the project in its operate/utilize phase.

Table 1. Respondent opinion scale (-2 to +2)

PERSONAL OPINION	SCORE
Strongly agree	+2
Agree	+1
No opinion	0
Disagree	-1
Strongly disagree	-2

Table 2. Respondent relevance scale

PERSONAL RELEVANCE	SCORE
Very important	5
Slightly important	4
Neutral	3
Slightly unimportant	2
Not important	1

Desirable relates to the attractiveness of the project and speaks of intrinsic value to the client/end-user or local community. It may include beauty, elegance, quality, empowerment and other intangible attributes that bring delight and happiness, or enable transformation. *Adaptable* relates to the flexibility of the project and its ability to accept change without causing too much unnecessary disruption or churn. It may include future modifications or change of purpose, process re-engineering and avoidance of becoming prematurely obsolete. *Practicable* relates to the project being fit for purpose and fulfilling the needs and expectations of the client/end-user or local community in terms of functionality and utility. Does it work well? Does it deliver on what was specified or needed? Finally, *serviceable* relates to the enduring nature of the project. Is it a project that will be treasured in future years and capable of upgrade as and when required? It may aid sustainability, operational energy profile, future-proofing and contributions to those it aims to serve. Is it in harmony with its natural surroundings?

While the four identified success factors are generic and share the same method of assessment and arrival of an overall satisfaction score, the contextual questions to assess them will need to be customized to the peculiarities of the project itself. For example, an office fit-out project might consider contextual questions for desirable, adaptable, practicable and serviceable criteria concerning issues such as décor, workstation configuration, secure storage space and energy star rating respectively, while a live concert project might consider the popularity of the headline act, provisions in case of inclement weather, sound and lighting innovation and safety of the crowd on the day of

the event. Contextual questions cannot be generic, and may even need to be tailored to different groups of stakeholders (such as employees, local community, visitors, etc.).

3.4 Benefit Realization

There is horizontal connectivity between success factors (e.g. feasible > within budget > desirable). This connectivity ties back to wider system characteristics of financial, social, political and environmental consequences. Factors within phases have equal weight and, when combined together, negative scores for any phase indicate an unsuccessful project outcome. Overall success is the mean (unweighted) score of design, deliver and delight, each judged by a different stakeholder group. High scores are preferred.

Table 3 describes the connections between success factors over time (scores provided are for illustrative purposes only).

Table 3. Phase-consequence matrix

CONSEQUENCES	PROJECT INITIATE	PROJECT IMPLEMENT	PROJECT INFLUENCE	SCORE (%)
Financial	feasible	within budget	desirable	78
Social	useable	on schedule	adaptable	69
Political	achievable	as specified	practicable	71
Environmental	sustainable	no surprises	serviceable	62
SCORE (%)	80	58	72	**70**

There is an implication in *i3d3* that higher levels of project success lead to greater benefit realization and collective utility. But this is far from guaranteed. Social cost-benefit analysis, which is outside the scope of this paper, is likely to still be the best method to measure these things (Langston, 2005). It too would consider financial, social, political and environmental consequences, but would express outcomes in the form of a discounted cash flow. While this technique is used to model expected outcomes, especially for large projects, it is rarely if ever used in hindsight to verify that benefits were actually realized. Monetary calculations also inherit problems of different currencies, equivalent purchasing power and accounting for macroeconomic changes over time.

4 Discussion

A key measure of overall success is benefit realization (Serra and Kunc, 2015). Benefits include both tangible and intangible criteria and hence they resist conversion into monetary terms. Successful projects should aim to bring a positive collective utility to our society, even though there will always be winners and losers. For a project to be successful, it must show this consistently over time (i.e. reflect good design, effective delivery and make a lasting contribution). Benefit realization requires a long-term view of a project, and cannot be confined to what has traditionally been described as implementation.

Projects have some common characteristics. First, they can be divided into a sequence of initiate (design), implement (deliver) and influence (delight) phases that reflect the life cycle for the intervention. Second, each phase potentially has financial, social, political and environmental consequences for stakeholders, and these stakeholders vary

over time. Third, phases and consequences create a matrix of success criteria that are capable of individual and collective measurement using a common scale (-100 to +100).

The previous discussion of *i3d3* has identified twelve generic criteria for measuring success. During the project initiate phase, successful projects must demonstrate that they are feasible, useable, achievable and sustainable. There is a sequence for these criteria, in that before being concerned with a project's sustainability it first needs to be achievable, before worrying about its achievability it first needs to be useful, and before deciding if it has useability it first needs to be feasible. During the project implement phase, successful projects must be delivered within budget, on schedule, as specified and with no surprises. Here there are clear trade-offs, and an equation can be employed to determine the essential change between what was planned and what actually happened. This change can be positive or negative. During the project influence phase, successful projects must be relevant to the end-users in terms of whether they are desirable, adaptable, practicable and serviceable. Each phase needs to produce a positive outcome that reflects success on a fixed scale, and over time acceptable benchmarks can be determined to add further insight to the interpretation of performance.

The objective of this research is to ultimately eliminate the controversy over what is judged as successful and what is not. Further, the model proposes that different techniques are used during each phase to best capture the evaluation of identified criteria. Clearly success is judged in 'the eyes of the beholder' and hence multiple stakeholder groups must be involved.

Looking at financial consequences, a successful project must be feasible to do, delivered within budget, and desirable to those for which it is intended to serve (Kerzner, 2017). Feasibility is often measured as a ratio of benefits to costs (BCR), where the result BCR>1 might be considered as a sign of success as it is likely to return a profit (Berssaneti and Carvalho, 2015). The higher the ratio, of course, the happier those with a financial interest in the project will feel (Zavadskas *et al.*, 2014). Once a budget has been set, staying within it is important to those charged with its delivery. But regardless of whether both of these criteria are achieved, if the end-users have little interest in it, its success up until that point might be somewhat meaningless.

Looking at social consequences, a successful project must be useable and help people, be delivered in a timely fashion, and be adaptable to changes in people's needs into the future (Sy, 2007). Useability can be measured via an opinion survey of a representative sample of people affected, and would need to show positive local support. Once its purpose is proven, the project would need to be competed as soon as possible. To avoid premature obsolescence, the project would also need to be sufficiently adaptable to meet changing requirements without significant new investment.

Looking at political consequences, a successful project must be achievable in terms of the rewards and risks (pros and cons) of the intervention, delivered to specified standards, and address the needs of end-users in practice (Serrador and Pinto, 2015). Achievability is a function of the probability of positive and negative risks and their impact on stakeholders. It demands that design is reconciled against actual performance to ensure that initial expectations are fully realized.

Looking at environmental consequences, a successful project must be sustainable over its designed life, involve no nasty surprises or undesirable consequences, and be serviceable in the context of providing an enduring legacy into the future (Sanz-Calcedo *et al.*, 2015). In terms of environmental impact, one may consider current regulatory

requirements and the project's footprint (Sánchez, 2015). Life cycle analysis is an appropriate technique for assessing the level of sustainability in an objective fashion.

This approach used in *i3d3* is expected to apply to projects of any type, size or location. Scores are not based on currency, timing or other date stamp. Criteria are generic. Size may affect the quantum of benefits realized but not the requirement for benefits and positive collective utility. The approach is also applicable to any country, rich or poor, and hence can support global comparisons.

There is a disconnect, however, between the three phases as a result of changes in stakeholder power and interest (Griffith *et al.*, 1999). This can be mitigated by effective communication and the use of technologies to share knowledge and ensure that objectives are consistently pursued over time. Project success planning ought to involve strategic thinking and management (Shenhar *et al.*, 2001). Phases should not be compartmentalized but rather provide opportunities for feedback and learning. Torbica and Stroh (2001) assert that if end-users are satisfied, the project can be considered successfully completed in the long run. However, a communication bridge from project initiate through to project influence is essential to ensure that benefits are indeed realized. In other words, what is important is that right projects are done right. This is the essence of project success.

Success is a function of stakeholder satisfaction and is reflected in the relationships that are formed and maintained between key people over time. With that comes the realization that there is more than one stakeholder to please, that project objectives will vary between them, and that the passage of time is an important ingredient in understanding and quantifying satisfaction. Judging criteria should be transparent. But none of this precludes generic criteria independent of project type, size and location. Obviously, not all projects will be successful – for example, some may just be motivated by self-serving political imperatives or be poorly planned responses to an emergency situation – and fail to deliver the benefits or collective utility demanded of them. Being able to rank projects in hindsight according to their level of success, however, is still valuable. It enables both reflection and continuous improvement to occur, ensuring we have an opportunity to learn from things that worked and from things that didn't.

In applying the proposed *i3d3* framework, it might be concluded that 'the devil is in the detail'. Can we reasonably place a number on each criterion so that we can determine mean scores horizontally and vertically within the phase-consequence matrix? Can a doghouse actually be more successful than an opera house, and can such a conclusion be defended? Is it even useful to make such diverse comparisons? These questions require further investigation and empirical testing. This paper is merely the beginning of a quest to find a way forward to quantify success or at the very least to establish clear criteria for how, when and by whom success is ultimately to be judged.

5 Conclusion

Project success is a topic fraught with difficulty due to a lack of agreement about its measurement within the existing literature. Adding to the confusion, projects (or even programs, as aligned groups of projects) are seen as having a defined beginning and end, after which they commonly enter a period of application that is considered outside the project's boundary. We need to talk about 'product success' instead of project

success. But whatever the terminology, it is clear that success cannot be determined at a solitary point in time, nor can it be assessed from a singular perspective.

The next steps must be to develop detailed models, test and validate them on real projects across a wide range of type, size and location, and promote the importance of measuring success consistently into the future as an extension of the 'lessons learned' protocol. It is the responsibility of the project manager, in our opinion, to take the lead on this.

6 Acknowledgement

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Will off site manufacture destroy employment in the construction industry?

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Abstract:
Recent years have seen a rapid rise in the percentage of offsite manufacturing of elements and components for building construction projects. The potential benefits of offsite construction are well known and have been demonstrated in a wide variety of project types. There has been some speculation that the result of this change might be a loss of onsite jobs and a net transfer of construction work to lower wage economies overseas. As is often the case, a realistic picture of the results of structural change is more nuanced. There may be winners and losers in this story. Several Australian construction enterprises are already embracing the possibility of new modes of operation which can carve out a viable slice of the project delivery market in the face of new global competitors. The aim of this paper is to report on two case studies of companies who are achieving growth while delivering quality outcomes in an increasingly disruptive industry context. It would seem that there is potential for future competitive locally based companies who can compete successfully in the global construction context.

Keywords:
Offsite construction, globalisation, competitive advantage, disruption.

1 Introduction

Many industries have experienced the turbulence of disruptive change and unanticipated competition (Christensen et al. 2002). The construction industry has tended to feel itself to be largely immune to disruptive globalisation because national jurisdictions control their own building regulations and because the cost of shipping heavy construction materials around the world was thought to be prohibitive. There is evidence that this may be changing and the construction industry may feel the pressures of globalisation already experienced in other industry sectors.

Press barons once felt that classified advertisements in newspapers were 'rivers of gold' that would permanently subsidise high quality journalism. However, they did not foresee that online competitors would very quickly replace newspapers as the main source of employment, real estate, tender notices and personal advertisements. At the same time, social media has usurped the traditional role of the press as the primary information source on current events. The result is that long established journals have struggled to find a role in a new more competitive environment and permanent employment of journalists has plummeted (Plunkett 2005).

Other industries have been disrupted by specific technological innovations. Digital cameras have virtually obliterated the film camera and its associated delivery services.