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Assessing Project Success: Moving Beyond the Triple Constraint

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ABSTRACT

This paper reviews the literature on IS project success evaluation and finds that the concept of success as currently used in both academia and practice based on the notion of the "triple constraint" – project scope, budget and schedule. This notion of success, derived from engineering, implicitly separates the project to develop the IT artifact from its implementation in the work system it is intended to serve. Additionally, it leads to relativism and lack of direction for project managers. Following Alter (2003), this paper proposes a new conception of project success based on the performance of the IT enabled work system. This conception is shown to be objective, transparent to non-IT managers and to provide direction to project managers in handling changes to projects.

Keywords

Project Success, Work Systems, Triple Constraint

INTRODUCTION

How do we know when a IS project is a success? Clearly one that fails to deliver a working IT artifact is a failure. But what of one that delivers an artifact that is not used? Or one that is used, but doesn't deliver the benefits anticipated? Or what of one that delivers the benefits anticipated but runs over its budget or schedule? How far must the overrun occur for the project to be considered a failure? The 2006 Standish study reported that 46% of projects either had cost or time overruns or didn't fully meet the user's needs (Rubenstein 2007). Similarly, Keil and Mann found that 30 to 40% of project experienced some level of project escalation (Keil and Mann 1997). Are all these projects failures? Are they simply "challenged" as Standish suggests? (Rubenstein 2007)

The current conceptualization of project success as taught to our students is that a project must meet the "triple constraint" of scope, budget and schedule in order to be considered a success. If we set these at the beginning, and establish the stakeholder priorities as to which of these should be maintained, then we have the basis of knowing how to trade-off one priority against another. In so doing, we run into the conflicts in priorities between stakeholders and the need to manage stakeholder expectations and negotiate trade-offs between stakeholders. Then as the environment changes and events occur and we go enact changes in the project in terms of increasing the budget or schedule or decrease the scope we run into the morass of managing the stakeholders again. And in the end a project is completed and depending on the stakeholder, it is consider a success, failure or most commonly a disappointment.

To avoid this conundrum and attempt to provide a way forward, this paper will examine the current conception of IS project success and look at the issues arising from such conceptions. It will then propose a new conceptualization of IS project success that provides a more objective approach to the assessment of IS project performance. The contribution of this paper is to provide a reconceptualization of project success based on the Alter's Work System model that is objective, transparent to non-IT managers and provides direction to project managers in handling changes to projects.

THE TRADITIONAL VIEW: THE TRIPLE CONSTRAINT

The PM textbooks tell us that project success is composed of meeting the functional requirements of the project on-time, and on-budget. For example, some of the leading textbooks tell us:

> *To create a successful project, a project manager must consider scope time and cost and balance these three often-competing goals. (Schwalbe 2007, p. 8)*

> *Every project is constrained by a list of customer-requested requirements (scope), the amount of time available to produce the system in support to the requirements (time), and the limit of the money available (cost). This is referred to as the triple constraint of project management. These three basic criteria are generally used to evaluate the success of a project. (Brewer and Dittman 2010, p. 14)*

> *The most commonly recognized project metrics are time, cost and performance. In combination, they form a set of potentially competing project priorities known as the triple constraint. …[The] [t]riple constraint definitions … form a successful program. (Brown and Hyer 2010,p. 9)*

> *Successful project management can … be defined as having achieved the project objectives:*
> *Within time*
> *Within cost*
> *At the desired performance/technology level*
> *While utilizing the assigned resources effectively and efficiently*
> *Accepted by the customer (Kerzner 2009,p. 3)*

> *Quality and the ultimate success of a project is traditionally defined as meeting and/or exceeding the expectations of the customer and/or upper management in terms of cost (budget), time (schedule), and performance (scope) of the project. (Larson and Gray 2011, p. 106)*

From these definitions, we can see that the received wisdom taught to our students is to be able to hit each of the components of the "triple constraint": on time, on budget and with agreed upon functionality. Each of these components, the textbooks tell us is to be taken relatively equally with the others and balanced against them. For example:

> *Managing the triple constraint involves making trade-offs between scope, time, and cost goals for a project. (Schwalbe 2007, p. 9)*

> *Project managers have to juggle the three constraints and come up with a trade-off, based on the priorities placed on the time constraints. (Brewer et al. 2010, p. 15)*

> *An organization must clearly establish the relative priority of triple constraint criteria. (Brown et al. 2010, p. 9).*

> *One of the primary jobs of the project manager is to manage the trade-offs among time, cost and performance. (Larson et al. 2011, p. 106)*

Project Success is Relative

However, at the same time, project success is not to be seen as simply meeting the pre-defined triple constraint set as adjusted during the project:

> *Project* success *and* failure *are relative terms. Failure is the condition or fact of not achieving the desired end or ends: success is the achievement of something desired, planned or attempted.* Whether a project is a success or failure is in the eye of the beholders*, that is, those individuals, enterprises, agencies, institutions, who are the stakeholders. (Cleland and Ireland 2007, p. 334 emphasis is the authors).*

Thus project success is in the eye of the stakeholders. While we would like to say that we have a clear set of goals by using the triple constraint, we see that this varies based on the perspective of the stakeholder.

And the view of the project by the stakeholders is something that can be managed: depending on how the project is represented to the customer, the amount of failure or success may be controlled. For example, a project may be presented to the stakeholders either "pessimistically" or "optimistically" planned (Kerzner 2009). By pessimistically planning, we show that amount of project results which is acceptable to the customer which is within our capability

to produce thus failure could be seen as only that failure to deliver between what we promised and what was actually delivered. Optimistic planning on the other hand shows how if we promise more than can be delivered, our failure is perceived as much larger. Thus success becomes a matter of presentation and perception between the project manager and the customer.

The Empirical Literature

The traditional view is also the dominant view in the empirical literature (de Bakker, Boonstra and Wortmann 2010). De Bakker and colleagues surveyed the empirical literature on the contribution of risk management to IT project success in peer-reviewed journal publications from 1197 to 2009. They found 29 articles, which discussed how risk management affected project success. They analyzed these articles to determine who they assessed project success. The found that 22 of the 29 articles used all or some the traditional success criteria to operationalize the concept of project success.

Of the others, they found some that extended the traditional criteria by the use of other criteria. Jiang, Klein and Means (2000) extended the traditional criteria with the additional of using technical expertise productively, working well with other parts of the organization, and the overall advantage of having teams. Procaccino and Verner (2006) extended the traditional measures by adding Completing a project, Having that system consist of solid, thoroughly tested code and the System was is easy to use. Han and Huang (2007) extended the traditional measures by adding reliability, ease of maintenance and quality.

Another method was to evaluate project success as the success of the resulting information system. In this case, the study used categories similar to that of Delone and McLean (1992; 2003). For example, Jiang and Klein (1999) used the criteria of satisfaction with the development process, satisfaction with system use, satisfaction with the quality of the IS product, and impact of the IS on the organization. Aladwani (2002) used task outcomes (Efficiency and Effectiveness), Psychological outcomes (satisfaction), Organizational outcomes (added value to business operations).

Additionally, in surveys of stakeholders, it has been found that, unsurprisingly, that different stakeholders have different emphases in success criteria. Internal project team members tend to be internally focused on the traditional criteria being focused on the targets set by senior management. The user community focuses on having a system that meets their needs with the other criteria as secondary to that (Agarwal and Rathod 2006).

Summary

In reviewing the literature, we find that the predominant definition of success is that of the "triple constraint." A project is successful if the project meets the requirements of on budget, on time and with agreed functionality as adjusted within the project. However, this criterion is based on the perception of the stakeholders. This perception will vary based on their own frame of reference. Such a perception can also be managed by how the project is presented to the customer for example. A distinctly minority view is to use the success of the resulting information system as the criterion for measuring success of a project.

Issues with the Traditional View

The traditional view has been criticized as being constructed from the point of view of the contractor and therefore needing to add additional criteria to take into consideration the needs of other stakeholders (Wateridge 1998). Additionally, it has been criticized as being created at the definition phase of the project, the time when requirements are most unstable and therefore not really suitable for judging the success of the contract (de Bakker et al. 2010). De Bakker, et. al further criticize the traditional view by saying that the traditional view was derived from the engineering disciplines where projects can be defined with specificity. In the IS field, projects are often subject to changes in requirements as the project proceeds resulting in changes in the schedule and cost (Han et al. 2007).

Additionally, the traditional view does not provide guidance to the project manager on how to trade-off budget or schedule for functionality. There is no formula to convert between them. Thus, the project manager is left to make the decision based on his experience or negotiation with the stakeholders. The stakeholders are also left in a similar situation not knowing how much a change in functionality is worth in terms of cost or schedule. We may be able to

calculate the change in cost by analyzing the effects of a functionality change. But this does not give us an indication of what the change is worth in terms of effects on the business.

Finally, the traditional view with its emphasis on engineering the artifact at least implicitly ignores a fundamental fact of IS activity: that the IT artifact is not constructed to exist in isolation. Rather it is created to be used by humans to accomplish their own purposes. Information systems perform a number of functions. They replace humans in processes to simplify work and codify organizational knowledge (Kogut and Zander 1992) in organizational processes. They also can substantially perform the process, or co-operate, enable or monitor the process (Cuellar, McLean and Johnson 2006). Therefore it seems that the IS project is bigger than simply delivering a well-engineered artifact that meets stakeholders specifications; it must also include how the organization will use the artifact to perform their work.

We have seen above that the traditional approach has the difficulties of focusing on the IT artifact as a standalone entity to be delivered, the relativity and manipulability of the concept of success and the lack of guidance that it provides to the project manager suggest that we need to consider a different approach to the assessment of project success. Alter (2003) has suggested that shifting the focus of IS research from the IT artifact to the IT enabled work system will allow us to generate better assessments of IT success. In the rest of this paper, we examine how changing the focus of the analysis of project success from the performance of the project to develop the IT artifact to the performance of the resultant IT enabled work system allows us to develop objective measures of project success that provide guidance to the project manager and are transparent to the non-IT managers.

A PROPOSAL FOR A NEW CONCEPTUALIZATION OF PROJECT SUCCESS

In this section, we propose a new conceptualization of project success to address the issues associated with the traditional triple constraint approach. We will argue that the unit of analysis of the project be shifted from the project to deliver an IT artifact to the effort to change the work system in which the IT artifact is to be embedded. This shifting of analysis will result in a conceptualization that allows us to focus on the needs of all the stakeholders, customers as well as project members and provides a mechanism to allow us to evaluate potential trade-offs and make non-subjective decisions about changes in scope, time and budget.

A New Definition of Project Success

To resolve the issues arising from the "triple constraint" approach, we propose the following conceptualization of IS project success. An IS project should be considered to be successful when:

> *an IS project results in an IT enabled work system that delivers financial benefits which are in excess of the proper thresholds on an ROI and/or opportunity cost basis.*

The key components of this definition include the following items that are explained in the following sections.

1) A shift in the level of analysis from the ITA development project to the an IT enabled work system
2) There is an explicit change in the scope of the IS project scope from ITA development to creation of an IT enabled work system.
3) The test criteria is changed from meeting the "triple constraint" to the performance of the targeted work systems

Shifting the Level of Analysis to the ITA Development Project to the Work System

In the traditional view, the focus is on the project to develop and IT artifact. Even when changes in the work processes that will use the IT artifact are considered in the project plan, the analysis is based on project considerations not on work system performance. We propose to shift the focus from the development activity to work system considerations. We suggest that Alter's Work System Method is an appropriate model on which to base this consideration.

Alter (2006) defines a work system as

> *… a system in which human participants and/or machines perform work using information, technology, and other resources to produce products and/or services for internal or external customers. (Alter 2006, p. 12)*

Alter indicates that the scope of a work system to be analyzed is the smallest work system in which the problems or opportunities to be analyzed exist. For our purposes here, it is the scope of the socio-technical entity that performs a single function using the IT artifact. This is necessary to provide the appropriate scope to determine the effect of the IT artifact on the process, product or service produced.

The components of the framework are show in figure 1. The four shaded boxes are the basic components that do the work in the system. The other five elements describe the context of the work system. Processes and Activities are all the activities that are performed within the work system. In addition to business processes, it includes decision-making, communication, coordination and information processing (Alter 2010). Participants are defined as the humans who perform work. Alter clearly differentiates between humans and technology in his model. Humans perform the work and in execution of those activities use technology. Information includes codified and non-codified knowledge. Codified knowledge includes formalized information such as financial data and that used in performing transaction. Non-codified information is such information as verbal agreements and conversation. Knowledge is considered as a special form of knowledge. Technology includes not only the IT artifacts but other tools that help people work more efficiently such as automobiles and jack hammers. Additionally technology includes specialized techniques such as mortgage calculation formulas and flow manufacturing technology.

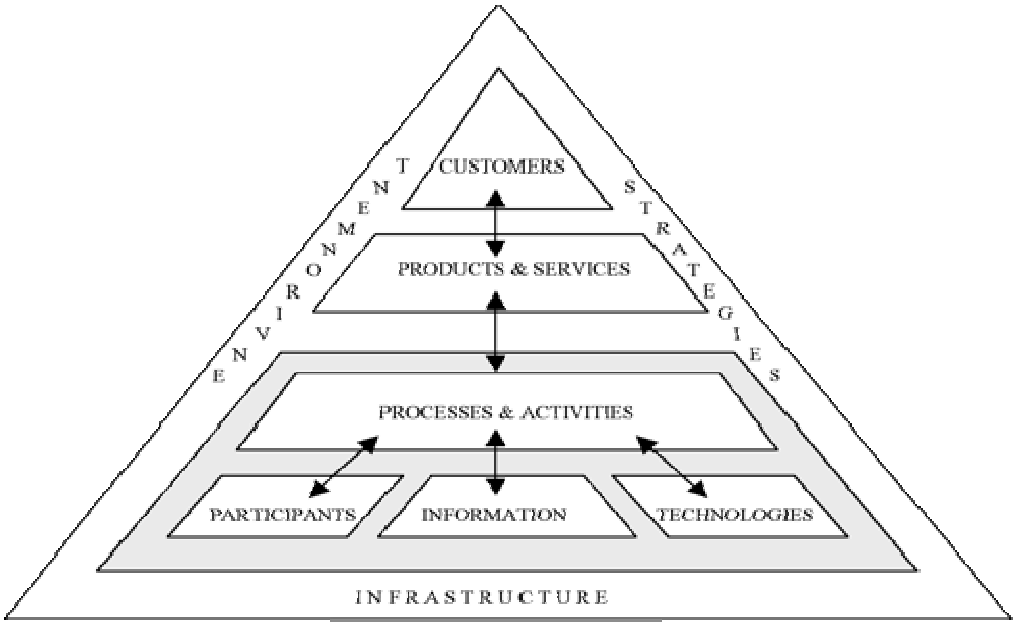

Figure 1: Alter's Work System Framework (Alter 2010)

Products and services are the combination of physical goods, information and services produced in the work system. Customers are the people who receive, use or benefit directly from the products and services that a work systems produces. The environment is the organizational, regulatory, cultural, competitive and technical environment within which the work system operates. Infrastructure includes the human, technical and information resources on which the work system depends to operate. Strategies include the guiding rationale and high level choices within which the work system is designed to operate.

The Work System Framework provides a useful way to describe work systems for use in business process reengineering activities or to understand how the work system can be constructed and operates. For our purposes here, it shows the interconnectivity between the various components of the work system and that, as Orlkowski and

Iacono (2001) indicate, the IT artifact itself is embedded within some context. Alter's framework provides us a theoretical set of relationships between the participants, information and IT artifacts and other technologies that interact within the processes and activities to produce the products of the work system.

From the standpoint of project success, Alter's framework, allows us to place the IT artifact within its intended use context. This is especially important since in most of the contexts for use of an IT artifact, the company is not in business to produce IT artifacts, rather, it uses the artifact to improve the performance of one or more work systems. For our purposes, this perspective allows us to create a much more objective evaluation methodology for evaluating project success as follows.

Scope Change of IS Development Activity

This change of focus from delivery of an IT artifact to delivery of a work system causes a scope change of activity. The project team must now explicitly consider the work system that will utilize the IT artifact and how the artifact will be used within the work system or work systems if it is to be utilized within multiple work systems. Business process management activities such as benchmarking and process redesign are now within the scope of the project. The work systems approach (Alter 2006) provides a methodology for assessing work systems that may be used for this activity. Thus the project scope is now not only the engineering of an ITA artifact but engineering of the work system that will use it.

Previously, IS projects and IS definitions of success have traditionally focused on developing an IT artifact (Alter 2003). Even where the context of use was considered, it was practically tangential to the project. With this conception, the context of use must be explicitly considered and designed along with the artifact. This will of course required co-design and production of the work system and thus will mandate far more interaction with work system participants.

Evaluating Project Success Using Work Systems

As described above, the purpose of the work system is to deliver products or services to a customer. The implementation of an IT artifact within the work system, therefore is intended to improve the performance of the work system in some way, either tangibly by reducing the cost of operating the work system, improving the efficiency of the work system by allowing more products or services to be produced while using less resources or it increases revenues to the company or intangibly by improving a characteristic such as service quality, R&D innovation or strategic fit with the organization. These changes should be expected to improve the financial performance of the work system.

In the case of tangible improvements this is straightforward. They might enable the reduction in head count of the participants in operating the project that would yield a direct reduction in cost. It might make the same number of participants more productive thereby being able to produce more products or perform more services than they were previously able to do. Additionally, it might make the service or product better so as to increase revenues to the organization.

While it might seem at first glance that intangible benefits might provide no financial benefits to the organization, we must recognize that for it to make sense for an organization to expend resources on a project, it must at some point expect that there will be financial returns from it. Even in the case of a non-profit organization, a project should justify the expenditure of resources by reduction in operating cost of the work system or improvement in the ability to raise funds. As an example, consider a project to improve the service quality of a work system. While this does not decrease the cost of operating a work system and in fact may increase it, the improvement in service levels might result in an increase in use of the products or services from the work system and therefore result in an increase in revenues to the work system from increased use. Similarly, a project that increases the strategic fit of a work system with the rest of the organization might not have positive cost reductions or immediate revenue increases, but at some point, the organization must expect a financial return to some part of the organization. This return should be factored into success calculation of the project. While clearly there are difficulties in estimating and later evaluating the financial effects of a project, this does not change the consideration that there should be financial returns to the company from the project.

The effects of a project can be measured financially in the performance of the work system, thereby lending itself to analysis by use of common financial methods such as IRR or NPV. A cost reduction, e.g. from head count reduction, can be measured in the expense line. Similarly, a revenue increase will be reflected directly on the revenue line. However productivity improvements or quality improvements can be somewhat more difficult to measure. A productivity enhancement will in the increase in the number of products produced or services performed. Similarly, an increase in quality results in a reduction of rework or scrap that would also be reflected in a productivity increase. For these types of changes, looking at the expense line will not tell the story, rather it would be reflected in the cost per item produced or services. Thus, in evaluating the cost or revenue effects of an IT artifact on a work system, the dollar amount should be calculated as a "cost per N products or services" rather than just a net expense increase or decrease. This cost per N items would be then used to calculate a total operating cost of the work system given a certain volume of products or services.

Since the effectiveness of the work system can be detected in changes in the financial performance of the work system. Standard financial measures can be used to assess the performance of the IS project that produced those changes. For example, a Net Present Value (NPV) analysis can be done to assess whether an effective return on investment has been received for the project. Those with a positive net present value would be considered successful.

This would require that performance of the work system prior to implementation of the IT artifact should be benchmarked. The work system should be defined and then the performance on the desired dimensions should be measured. After implementation of IT artifact, after an appropriate period for institutionalization of the artifact in the work system, the performance of the work system should be measured again.

A Hypothetical Example

As an example, suppose we have a project budgeted for $180,000 that is to be completed within one year. After implementation, assume the operating efficiency of the work system is to be increased by 10% meaning that the cost to process one item would decrease by 10%. If the original cost was $5 per item and 100,000 items were processed in a year, $50,000 in benefits are expected to achieved. Further consider that the organization evaluates projects on a net present value basis based on benefits received over the life of the system, in this case expected to be six years. The after tax cost of capital for the organization is five per cent. The NPV analysis of the project would be as follows (table 1):

Table 1: Initial Project Success Calculation

	Period							
	0	1	2	3	4	5	6	7
Project Cost	$180,000							
Project Benefits		$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	
Net	$(180,000)	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	

The NPV of this project is $70,271. A sensitivity analysis shows that the project can exceed its cost by about $74,000 before the NPV goes negative. Therefore any changes to scope that exceed cost by over $74,000 would cause the project to lose financial justification. In a similar mode, benefits may decrease by $14,500 per year before the project loses financial justification.

At the first stage gate review, after the analysis phase, the numbers are adjusted (table 2). It is projected that the project will last two months longer than expected extending into year one delaying the benefits by two months.

Table 2: First Stage gate Re-estimation								
	Period							
	0	1	2	3	4	5	6	7
Project Cost	$180,000	$30,000						
Project Benefits		$41,667	$50,000	$50,000	$50,000	$50,000	$50,000	$8,333
Net	$(180,000)	$11,667	$50,000	$50,000	$50,000	$50,000	$50,000	$8,333

We see from table 2 that the NPV of the project has declined to approximately $41,000. Alternately, the project could have performed an analysis of the effects of a scope reduction equivalent to the two months of work. They would have been able to remove functionality that would reduce benefits up to $14,500 per year before the project went no longer be cost justified.

At completion (table 3), the project actually ran over budget by three months and delayed benefits by 3 months. Additionally, the benefits expected to be provided by the project have been found to be less than expected – only 8% - so only $40,000 per year. The NPV is now $-21,187. Thus the project may be considered a failure. The analysis may be continued into the future to ascertain project continued project success.

Table 3: Final Project Cost								
	Period							
	0	1	2	3	4	5	6	7
Project Cost	$180,000	$45,000						
Project Benefits		$30,000	$40,000	$40,000	$40,000	$40,000	$40,000	$10,000
Net	$(180,000)	$(15,000)	$40,000	$40,000	$40,000	$40,000	$40,000	$10,000

In this example, we've seen how that by considering the project in the context of the work system, we've been able to use traditional financial justification measures to evaluate the project. They provided the initial justification for the project and later continued justification after changing conditions showed that the project retained justification. Similarly, it allowed an assessment after project completion to determine if the project had succeeded or failed in its objectives. Finally, it provides direction to the project manager as to how to proceed. As seen in the discussion of table 2, the analysis placed boundaries on the scope to be reduced or length of time to be added.

DISCUSSION

In this paper, we redefined project success in terms of the financial performance of the IT enabled work system. This redefinition shifts the focus of the project team from producing a technical artifact to producing an IT enabled work system and provides specific guidance to the project manager in a form that can be readily understood by non-

IT managers. This research changes the scope of the project from delivering a technical artifact to an IT enabled work system. Thus the traditional triple constraint analysis is not longer appropriate and is replaced by financial analysis of the performance of the work system.

It might be objected that this methodology is not really novel, that it is simply the well-known traditional financial justification of projects. While it does utilize those techniques, they have not been utilized in the literature to determine success or failure of projects. Additionally, they have not been used to provide guidance to project managers on how to re-scope or extend projects. The redefinition of the scope of an IT project to be the development of an IT enable work system requires this shift in assessment.

The advantages of this definition of project success over the traditional triple constraint can be defined as follows. First, It merges the interests of the project team with those of the stakeholders by changing the focus of the project from the delivery of a technical artifact to delivery of an IT enabled work system. By focusing on the overall performance of the work system, the project team focuses on developing an IT artifact that meets the needs of the customers because the success or failure of the project is based on the performance of the work system. Second, it provides an objective measure of success. By the use of the NPV analysis to evaluate the impact of the IT artifact on the performance of the work system, it provides a direct numerical rating that is controlled by the benefits and expenses received. Third, the IT artifact is treated as situated in the work system. This is in accord with the recognition that IT artifacts should be studied in their situated environment (Orlikowski et al. 2001).

Collection of the financial data to be able to compute the IRR or NPV may be challenging depending on the nature of the organization and its accounting methodology. Where project costs are collected in a single cost center or centers, this allows the project costs to be easily identified. However, where a functional team organization is used, it may be difficult to extract the expenses associated with the project without some form of activity based costing in which the costs of the different activities are split out. Similarly, quantifying the benefits is always a risky proposition. Especially where revenue projections are involved, most executives are loath to go out on a limp about without being absolutely certain of their prediction.

This change in the definition of success and realignment of level of analysis also has implications the skill sets of project managers. Since projects are now managed at the level of the work system instead of simply the IT artifact, project managers must be change agents at the business level as well as managers of technical projects. Indeed, Markus and Benjamin (1996) have pointed out that the view of the IS as being only concerned with producing a technological artifact that managers implement was even then "rapidly becoming unviable" (p. 399). They suggest that an "advocate model" in which the IS specialist seeks to "work to influence people's behavior in particular directions" (p. 397) is the most important for IS specialist who work on reengineering projects such as work system level change.

CONCLUSION

The proposal shown here has several limitations. First, we only considered direct costs of the project in our analysis. The analysis could also be done to consider opportunity costs of using the resources in a different project. Second, only financial measures were used here. It might be possible to consider strategic measures for a project (Larson et al. 2011). These would lend a different perspective to the project. In cases of strategic necessity, financial measures would be less important than delivering the needed functionality into the work system. Third, this paper has only given a proposal and theoretic assessment. Additional work should be done to apply this proposal to empirical studies and practice to assess its practical value. Finally, this study was performed assuming the development of the IT artifact to be placed in a work system such as is found in a traditional user organization. A different analysis would need to take place to determine how success should be defined within companies whose goal is to develop IT artifacts for sale.

This study examined the traditional "triple constraint" approach to assessing project success. Being derived from engineering its focus is on the performance of the project itself and does not explicitly consider the needs of stakeholders or the performance of the business after implementation. It proposed a change in the definition of success to be based on the performance of the IT enabled work system. This reconceptualization has the advantages of explicitly considering the needs of all stakeholders, provides a transparent measure of success to all stakeholders, objective direction to the project manager and considers the IT artifact in the context of how it will be used.

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