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PAPERS

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ABSTRACT

Growth in the use of programs has led to a requirement of understanding what constitutes program success. A measurement construct for program success, which comprises four dimensions—delivery capability, organizational capability, marketing capability, and innovative capability—was developed based on 172 responses to a web-based questionnaire to program managers. Analysis of variance (ANOVA) and canonical correlation analysis were applied to test for the relationship between program success and program context. Results showed that the measurement construct for program success was stable over different types of program contexts. It provides a tool for further investigation into program success assessment.

KEYWORDS: program success; program context; measurement construct; success school

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INTRODUCTION

Programs provide a transformational way to integrate projects and organizational strategies (Murray-Webster & Thiry, 2000; Partington, 2000). They are now widely used by a large number of organizations. Maylor, Brady, Cooke-Davies, and Hodgson (2006) called this emergent tendency "programmification." Growth in the use of programs has led to a need to better understand the phenomenon of program success.

At the outset, program success should be positioned against project success. Studies on project success have been popular since the 1980s (see, for instance, Freeman & Beale, 1992; Jugdev & Müller, 2005; Pinto & Slevin, 1988; Shenhar & Dvir, 2007; Shenhar, Dvir, & Levy, 1997; Turner, Zolin, & Remmington, 2009). However, program management requirements differ from project management requirements (Shao, Tuner, & Müller, 2009). Project management usually focuses on performance at the tactical level, like meeting the requirements of time, cost, and quality, whereas program management takes a more holistic perspective in order to bring about the fundamental and transformational changes in organizations (Maylor et al., 2006). This implies a difference in success measures of the two concepts.

Shao et al. (2009) reviewed literature on program success and found that the definitions for program success still remain at the conceptual level. Little literature was found that offered measurement dimensions for program success. For example, guidance and standards in program management, such as *The Standard for Program Management,* developed by the Project Management Institute (PMI, 2008) and *Managing Successful Programmes (MSP),* developed by the Office of Government Commerce (2007), assessing program performance from the perspectives of its value creation and learning loop. Pellegrinelli (1997), Lycett, Rassau, and Danson (2004), and Reiss et al. (2006) linked program success with bringing about organizational change. Partington (2000) and Maylor et al. (2006) suggested that program success lies in the achievement of organizational strategies through programs. Although all these studies provide insights on program success assessment, little indication on specific program success measurement constructs was found. Shao and Müller (2011) attempted to develop the constructs for program success through their interview-based qualitative study. Although their study was based on a small sample, it provided a step forward to further explore the measurement of these program success dimensions.

No project or program exists in isolation (Engwall, 2003). To achieve program success, program context needs to be taken into consideration. Pellegrinelli, Partington, Hemingway, Mohdzain, and Shah (2007) observed in their case studies that contextual factors in program management often draw much of program managers' attention and efforts, cause them to make compromises, and reshape their programs. Lycett et al. (2004) also indicated that effective program management approaches should be dynamic and flexible, adaptable to changing contexts, and relationship-based.

The purpose of this study is to develop a measurement construct for program success. For that the study builds on earlier findings and empirically develops a set of measurement scales and dimensions for program success. Furthermore, the interaction between program success and program context is examined to test for stability of the program success measurement construct in different program contexts. The following research questions are addressed, and program success is the unit of analysis:

- What are the measurement dimensions and scales for program success?
- Are these program success measures stable over different program contexts?

The next section reviews earlier research on program success and program context to identify knowledge gaps. Then the research methodology is described. This is followed by the data analysis results and discussions. Finally, the conclusion presents the main findings of the research and highlights the managerial and theoretical implications of the results.

Literature Review

This section starts with the success school of project management as it provides the theoretical perspective for the study. Then the literature on program success and program context is reviewed.

Success School of Thought in Project Management Research

The project management success school of thought links the study to the recently developed nine schools of project management. This concept distinguishes between nine paradigms in project management research: the optimization school, the modeling school, the governance school, the behavior school, the success school, the decision school, the process school, the contingency school, and the marketing school (Turner, Huemann, Anbari, & Bredillet, 2010).

This study contributes to the success school through identification of measurement dimensions and scales for program success. The success school focuses on project success factors and success criteria (Turner et al., 2010). Success factors refer to the elements of the project and its management that can be influenced to increase the chance of a successful outcome. Success criteria are those measures (both quantitative and qualitative) against which a project is judged to be successful (Turner, 2007). The same applies to programs, as programs have their roots in projects (Maylor et al., 2006).

Literature Review on Program Success

Guidance and standards in program management, such as *The Standard for Program Management*, by the Project Management Institute (2008) and *Managing Successful Programmes,* by the Office of Government Commerce (2007), advocate evaluating program success through benefits realization. A benefit is defined as the measurable improvement resulting from an outcome that is perceived as an advantage by a stakeholder (OGC, 2007). Benefits can be financial or nonfinancial, tangible or intangible (Hertogh, Baker, Staalong, & Westerveld, 2008). A chain of benefits needs to be realized during a program, where benefits accomplished early in the program provide funds, personnel, resources, and justifications for pursuing the later benefit. This process continues until all benefits are realized and the program objectives are achieved (OGC, 2007).

Thiry (2002) suggested appraising program performance from a life-cycle learning loop perspective. He saw programs as long-term processes whose expected benefits may change over time. He suggested that iterated appraisals of strategic benefits achievement and stakeholders' satisfaction should be embedded in the program control process. Thiry (2004) clarified that the underpinning paradigm of program management lies in strategic management, which is in line with Partington (2000) and Maylor et al.'s (2006) statement that program success is linked with the achievement of organizational strategies. Along this line, Pellegrinelli (1997), Lycett et al. (2004), and Reiss et al. (2006) associated program success with bringing about organizational change.

This earlier research provided insights into program success, but little indication on specific program success constructs is found. Shao and Müller (2011), in their attempt to develop the constructs for program success, identified six dimensions: program efficiency, impact on program team, stakeholder satisfaction, business success, preparation for the future, and social effects. Although their studies were among the first to generate program success dimensions, they have not defined the related measurements. The review above indicated a knowledge gap in the measurement constructs for program success. We propose to develop through the present study *a measurement construct for program success, including measurement dimensions and scales.*

Literature Review on Program Context

The literature in program management emphasizes the importance of context for the management of programs. Program context in the existing literature is defined as the "dynamic cultural, political and business environment in which the program operates" (Pellegrinelli et al., 2007, p. 41). Pellegrinelli et al. (2007), Lycett et al. (2004), and Pellegrinelli (2002) advocated that effective program management approaches should be adaptable to changing context. Program directors and managers should take the responsibility of shaping a context for program and projects. They saw a program as embedded in its context and aligned to the evolving organizational strategies, while simultaneously sheltered from the external turbulent and uncertain environment. These authors assumed an

interaction between program context and program management.

Based on previous research, Shao and Müller (2011) developed qualitatively a preliminary set of dimensions for program context, which included three aspects: program typology, the scope, and characteristics of program context. Within the latter dimension, four subdimensions were identified: stability, harmony, support, and adaptability of program context. These dimensions provide the basis for the further operationalization of the concept of program context, which will be used to test the interaction between program context and program success.

Research Methodology

A post-positivism perspective with a deductive approach was used in this study in order to operationalize the program success and program context concepts from Shao and Müller (2011). A worldwide cross-sectional questionnaire was used for quantitative data collection, which then allowed for generalizable results.

Questionnaire Development

Four sets of questions were included in the questionnaire. The first two sets addressed the measures of program context in terms of program typology and program context characteristics, the third set measured program success, and the last set collected respondents' demographic information. Question items were developed based on existing theories and the prior work by Shao and Müller (2011); see Table 1. Questionnaire development followed the suggestions of Churchill (1979).

The following dimensions to assess program context were considered:

- *program typology*, assessed through a series of program attributes (based on OGC, 2007; Pellegrinelli, 1997; PMI, 2006), such as industry, size, nature, and type and
- *program context characteristics*, assessed by the four dimensions of stability, support, harmony, and adaptability (Shao & Müller, 2011),

Dimension	Question
Program Context Characteristics	
Stability	Stability of parent organizational structure Stability of the program-related processes Stability of the relationship with stakeholders
Harmony	Relationship between program and top management Relationship between program and functional departments Relationship between individual project managers Fit of projects with organizational business requirements Fit of projects with program objectives Stakeholder engagement
Support	Support from top management Resource availability Funding availability Organizational learning
Adaptability	Fit between program and organizational strategy Flexibility of program structure Flexibility of program procedure Adaptability of program to the context
Program Success	
Program Efficiency	Deliver within time frames Deliver with budgets Meet functional requirements
Impact on Program Team	Team-member satisfaction Specialty improvement Low fluctuation
Stakeholder Satisfaction	User satisfaction Customer satisfaction Supplier satisfaction Sponsor satisfaction Other stakeholders' satisfaction Stakeholder engagement Customer loyalty
Business Success	Business results Increase market share Reoccurring business Power of influence
Preparation for the Future	New technology Technology leverage New market More efficient process Organizational capability
Social Effects	Social economic benefits Improvement of quality of lives for citizens Environmental value Science and technology development Social evaluation

Table 1: Links between questions and dimensions in the questionnaire.

using five-point Likert scales on 17 question items.

Program success was operationalized using six dimensions of program efficiency, impact on program team, stakeholder satisfaction, business success, preparation for the future, and social effects (Shao & Müller, 2011). Twenty-seven questionnaire items were developed to measure these dimensions on five-point Likert scales. A sixth point was added to the last three dimensions representing an "I don't know" answer. The purpose for this was twofold:

- The last three dimensions of program success measure the middle- to long-term success of programs. Program managers may not have answers to these questions. Therefore, we need to distinguish between the neutral attitude to success judgments and real unawareness of them.
- Data collected through the questionnaire are individuals' attitudes or opinions on the subjects. This will inevitably bring in response bias stemming from self-reports. To mitigate this effect, we changed the measurement scales, as suggested by Podsakoff and Organ (1986).

Table 1 cross-references question items, program success, and program context dimensions.

The questionnaire was tested using seven program managers. Minor edits were made afterward. The responses obtained from the pilot test were not included in the final data analyses.

Sampling

A snowball approach to sampling was used. Program managers were targeted through professional management association public websites, such as PM World Today and the like, and direct and indirect personal contacts.

The underlying idea of using professional project management organizations to distribute the questionnaire was that a large number of program managers have project management backgrounds (Partington, Pelligrinelli, & Young, 2005), are organized in program management special interest groups within these organizations, or are members thereof. Thus, sampling errors can be reduced to a certain extent through this approach. However, snowball sampling makes it impossible to control questionnaire distribution and does not allow for calculation of response rates.

The number of responses totaled 174, of which 172 were used for analyses. Thirty-five percent of the respondents were 40 years old or less, 38% were between 41 and 50 years, and 24% were older than 50 years. Fifty-eight percent had up to 5 years of work experience as program managers, 31% between 6 and 10 years, and 9% more than 10 years. Program information is shown in Table 2.

Table 2 shows that the programs in the sample were distributed relatively evenly in terms of industries. This contributed to the generalization of the results. Programs of medium to large size dominated the sample, which differentiates our sample from global projects, which are said to be predominantly of small to medium size (Turner, Ledwith, & Kelly, 2009). We conclude from this that different principles apply to programs and projects. Temporal types of programs (i.e., those with a predefined end date) were dominant. This echoed the dominance of goal-oriented types of programs.

Research Procedures and Data Analysis Methods

We started with a factor analysis to identify the underlying structures and psychological patterns of program success (Field, 2005). Through this, the program success measurement construct and its underlying dimensions were developed. Analysis of variance (ANOVA) was used to identify possible significant differences in terms of program types, industries, sizes, and nature of programs (Field, 2005). Finally, canonical correlation analysis (CCA) was used to test for relationships between the program success measures and the program context measures (Hair, Anderson, Tatham, & Black, 1998).

Factor Analysis

Factor analyses were used to identify the underlying structures for both program success and program context characteristics. They were used to

Dimension	Attribute	Frequency	Accumulation
Industry Area	Engineering	30.2%	30.2%
	Information and communication	40.1%	70.3%
	Organizational change	29.1%	99.4%
	Missing value	0.6%	100%
Program Size	Small	15.7%	15.7%
	Medium	44.8%	60.5%
	Large	39.5%	100%
	Missing value	0	100%
Nature	Temporary	76.2%	76.2%
	Semipermanent	23.8%	100%
	Missing value	0	100%
Type	Portfolio	24.6%	24.6%
	Goal-oriented	59.6%	84.2%
	Heartbeat	8.8%	93.0%
	Compliance	7.0%	100%
	Missing value	0	100%

Table 2: Program information.

reduce the data set to a manageable size while retaining as much of the original information as possible (Field, 2005). Exploratory factor analysis was applied in the study because of a lack of preconceptions of program success and program context, as exploratory factor analysis searches for unknown underlying structures in the data (Grimm & Yarnold, 2005). The results from factor analyses are described in the Research Findings section.

ANOVA

ANOVA was used to test for significant differences in mean values of program success dimensions among different program types. Through ANOVA, we examined whether the program success measurement construct was stable across different types of programs.

Canonical Correlation Analysis

CCA was used to describe the nature of the association between program success measures and program context measures. As a technique, CCA is used to test for relationships between two sets of variables, especially when there is no *a priori* knowledge about these relationships (Hair et al., 1998; Lambert & Durand, 1975). Through CCA, we tested for a possible effect of program context on program success, which allowed us to assess the stability of the program success measurement construct over different types of program contexts.

Validity and Reliability

Validity shows how well the concept is defined by the measures, whereas reliability shows the consistency of the measures (Hair et al., 1998). Concept validity was ensured from the literature review, from which the research propositions derived. Construct validity was ensured through the use of existing theories and earlier research results for the definition of measurement dimensions and the development of questionnaire items (e.g., Pellegrinelli, 1997; Shao & Müller, 2011), pilot testing of the questionnaire, as well as achievement of sufficient item-to-item and item-to-total measures. External validity was ensured through testing for the role of the individual questionnaire respondent in order to generalize the study results to the program manager community. Reliability was ensured by asking multiple questions per measurement dimension and testing for acceptable Cronbach's alpha values per measurement concept (Cronbach, 1951).

Research Findings

Research findings unfold in three parts:

1. Program success measurement construct,
2. Program context measures, and
3. Interaction between program success and program context measures.

Program Success Measurement

Thirty percent missing values in the measurements of *social effects* led to an exclusion of these questionnaire items from further analyses (Field, 2005). Normality of the data was tested through skewness and kurtosis. The data satisfied the underlying assumptions of the multivariate techniques we used (see Table 3). Acceptable correlations, anti-image correlations, and a Kaiser-Meyer-Olkin (KMO) value of 0.845 (with significance $p < 0.001$), which is well above the minimum of 0.60 for exploratory factor analysis, showed the data's adequacy for factor analysis (Field, 2005; Hair et al., 1998).

Principal component analysis with Varimax rotation was performed, with a minimum Eigenvalue of 1.0 for factor acceptance (Field, 2005). Factor loadings at or above 0.45 were considered significant for a sample size of 150 to 200 (Hair et al., 1998). Iterative factor analyses were performed. The final model with four factors explained 64% of the variance and was interpretable (see Table 4).

We named the factors *delivery capability, organizational capability, marketing capability,* and *innovative capability.* Factor scores were saved and replaced the original data in further analyses.

Table 4 also shows the scale reliability being higher than the threshold of 0.60 (Field, 2005). Item-to-item correlations and item-to-total correlations were examined as well for each factor. The thresholds of 0.30 and 0.50, respectively, were all met. Therefore, we conclude that the final factor analysis model for program success was reliable. The program success construct comprises four program success dimensions:

- *Delivery capability* measures program success from the perspective of successfully delivering what the program is supposed to deliver, whether the stakeholders are satisfied with the deliverables, whether the expected business results are achieved, and so forth.
- *Organizational capability* measures program success in terms of the program's contribution to the improvement of organizational capacity, either from the "hard" side, such as improving the efficiency of processes and the like in their parent organizations, or from the "soft" side, such as influencing the organizational culture, changing the way of doing business, and so forth.
- *Marketing capability* measures the inner connection between programs and organizational strategies. It links Ansoff's (1957) organizational strategy from the marketing perspective to program success.
- *Innovative capability* measures program success from a technology development perspective, such as whether new technologies were developed in the program. This measure reflects the program's contribution to its parent organization in terms of preparation for future opportunities.

Among these four program success measurements, delivery capability is closest to tangible benefits. The other three dimensions measure the more intangible benefits of programs. Their combination corresponds to benefits

	N	Min	Max	Mean	*SD*	Skewness	Kurtosis
Program success variables							
Within time frame	172	1	5	3.81	1.191	−0.840	−0.206
Within budget	172	1	5	3.80	1.204	−0.821	−0.298
Meet functional requirement	172	1	5	4.18	0.883	−1.135	1.047
Member satisfied	172	1	5	3.92	0.943	−0.864	0.738
Improve skills	172	1	5	3.97	0.970	−1.109	1.193
Low fluctuation	172	1	5	3.93	1.006	−0.800	0.056
User satisfaction	172	1	5	4.19	0.881	−1.009	0.639
Customer satisfaction	172	1	5	4.12	0.873	−1.093	1.333
Supplier satisfaction	172	1	5	3.81	0.969	−0.619	0.145
Sponsor satisfaction	172	1	5	4.13	0.911	−0.973	0.466
Other stakeholder	172	1	5	3.71	0.877	−0.027	−0.323
Stakeholder willing to involve	172	2	5	3.73	0.851	−0.264	−0.499
Customer loyalty	172	1	5	3.89	0.914	−0.476	−0.145
Achieve business results	154	1	5	4.29	0.968	−1.653	2.754
Reoccurring business	120	1	5	3.96	0.947	−1.002	1.327
Power of influence	129	1	5	4.01	0.964	−1.025	1.159
New technology	128	1	5	3.52	1.310	−0.767	−0.413
Tech leverage	132	1	5	4.04	0.960	−1.022	0.704
New market	120	1	5	3.51	1.264	−0.578	−0.567
Efficient process	153	1	5	4.03	1.045	−1.210	1.254
Organizational capability	151	1	5	4.09	1.032	−1.353	1.714
Program context variables							
Stable organizational structure	172	1	5	3.64	1.113	−0.512	−0.672
Stable process	172	1	5	3.50	0.964	−0.277	−0.778
Stable relation stakeholder	172	1	5	3.61	0.901	−0.408	−0.154
Relation top management	172	1	5	3.88	0.887	−0.776	0.791
Relation functional department	172	1	5	3.60	0.909	−0.534	−0.151
Relation project managers	172	1	5	3.90	0.770	−0.763	1.532
Fit between projects and business	172	1	5	3.85	0.838	−0.734	0.820
Fit between projects and program objective	172	1	5	3.91	0.767	−0.707	1.448
Stakeholder engage	172	1	5	3.56	0.880	−0.641	0.461
Support top management	172	1	5	3.83	0.899	−0.638	0.238
Resources availability	172	1	5	3.53	0.881	−0.237	−0.416
Funding availability	172	1	5	3.66	0.939	−0.335	−0.359
Organizational learning	172	1	5	3.23	0.980	−0.281	−0.330
Fit between program and organizational strategy	172	1	5	4.19	0.797	−1.200	2.370
Flexibility program structure	172	1	5	3.74	0.959	−0.621	0.176
Flexibility program procedure	172	1	5	3.61	0.946	−0.827	0.732
Adapt external environment	172	1	5	3.64	0.923	−0.440	−0.020

Table 3: Descriptive statistics for program success and program context variables.

realization, a success dimension also defined in *MSP* (OGC, 2007) and *The Standard for Program Management* (PMI, 2008).

Program Context Variables

The same procedures of factor analysis as described in the previous section were used to identify the program context measures. It is based on variables of program context characteristics. Normality of the data was tested through skewness and kurtosis, with thresholds of ±2 and ±3, respectively (Hair, Babin, Money, & Samouel, 2003); see Table 3. Acceptable correlations, anti-image correlations, and a Kaiser-Meyer-Olkin (KMO) value of 0.798 ($p < 0.001$) indicated the data's adequacy for conducting factor analysis (Field, 2005; Hair et al., 1998). Table 4 shows the program context measures. These program context factors explained 61% of the variance and were interpretable. We named the factors *organizational fit, program flexibility, organizational stability,* and *resource availability.* Factor scores were saved and replaced the original data in further analyses. Table 4 also shows the scale reliability being higher than

Final Factor Name	Delivery Capability	Organizational Capability	Marketing Capability	Innovative Capability
Eigenvalue	5.947	1.868	1.391	1.057
% Variance explained	32.006	11.379	10.489	10.268
Accumulative %	32.006	43.385	53.875	64.143
Scale reliability	0.887	0.857	0.734	0.713
Within time frame	0.751			
Within budget	0.661			
Functional requirement	0.740			
Member satisfied	0.668			
User satisfaction	0.776			
Customer satisfaction	0.787			
Supplier satisfaction	0.684			
Sponsor satisfaction	0.727			
Other stakeholder	0.507			
Achieve business results	0.685			
Reoccur business			0.843	
Power of influence			0.787	
New technology				0.845
Technology leverage				0.855
Efficient process		0.925		
Organizational capability		0.881		

Final Factor Name	Organizational Fit	Program Flexibility	Organizational Stability	Resource Availability
Eigenvalue	4.324	1.682	1.301	1.167
% Variance explained	19.833	15.107	13.631	11.957
Cumulative %	19.833	34.939	48.571	60.528
Scale reliability	0.784	0.765	0.677	0.665
Stable organization structure			0.778	
Stable process			0.793	
Stable stakeholder relation			0.671	
Relation top management	0.673			
Relation project managers	0.641			
Projects fit organization	0.690			
Projects fit program	0.592			
Support top management	0.683			
Resources availability				0.750
Funding availability				0.866
Program fits organization	0.645			
Program structure flexible		0.771		
Program process flexible		0.876		
Adapt to environment		0.754		

Table 4: Final program success and program context factor models and reliability measures.

the threshold of 0.60 (Field, 2005). Both item-to-item correlations and item-to-total correlations met the thresholds of 0.30 and 0.50, respectively. Therefore, we conclude that the final factor analysis model for program context is valid and reliable. The program context measurement construct comprises four program context factors:

- *Organizational fit* measures the fit between the program and its organizational context in terms of organizational strategies, cultures, and internal power structures.
- *Program flexibility* measures the flexibility of programs in terms of program structures and program procedures.
- *Organizational stability* measures the stability of the program's parent organization. As the parent organization encapsulates the programs, its stability constitutes a prerequisite for program management.
- *Resource availability* measures the extent to which resources are available for programs. The term *resource*

refers to human resources, financial resources, and so forth. Resource availability is also a prerequisite for program management.

Impact of Program Context on Program Success

As indicated in the Research Methodology section, program context includes two dimensions, program typology and program context characteristics; the impact of program context on program success is discussed in two parts, the variance of program success over different program types and the impact of program context factors on program success.

Program Success and Program Types

ANOVA was applied to analyze how program success dimensions vary with different program types in terms of industries, sizes, nature, and types. Only two out of 16 different program types showed significant differences in program success, which were: marketing capability in different industries and innovative capability in different program sizes (both with significance of 0.011). Post-hoc Scheffe tests were performed to further identify the specific differences:

- Performance of organizational change programs is significantly higher than performance of information and communication programs in terms of their marketing capability ($p = 0.011$);
- Large programs perform better than small programs in terms of innovative capability ($p = 0.017$). However, in most cases (14 out of 16), program success dimensions do not significantly vary by program types. In other words, the program success measurement construct is relatively stable across different program types.

Relationships Between Program Context and Program Success

CCA was performed to test the relationships between program success and program context. CCA looks for the best correlation functions between the two sets of variates (Hair et al., 1998), here the program context and program success measures. The strength of the correlation was assessed by inspecting the magnitudes of both the canonical correlation coefficients and the redundancy index. Lambert and Durand (1975) recommended the redundancy index as a more indicative measure of the explanatory capability of canonical analysis.

The relative importance of a variable in each of the two variates is indicated by canonical loadings and canonical cross-loadings. Hair et al. (1998) recommended cross-loadings as the preferred method, because they provide a more direct measure of the relationships. A threshold for canonical cross-loading of 0.30 was used, as suggested by Lambert and Durand (1975).

As with any other multivariate technique, CCA should be subjected to validation methods to ensure the results are not specific only to the sample data and can be generalized to a wider population (Hair et al., 1998). The validation method used in the study was to split the sample into two subsamples with an equal number of responses, and compare the results for similarity from CCA on the half sample and the total sample, respectively (Schul, Pride, & Little, 1983). Sample size requirement of at least 10 observations per variable was met (Hair et al., 1998), even with the half sample (10.75:1); see Table 5.

Table 5 shows that two significant canonical functions in the total sample

	Half Sample (Random Split, $n = 86$)			Total Sample ($n = 172$)					
				Function 1			Function 2		
Variables	Canonical Loadings	Canonical Cross-Loadings	Redundancy Index	Canonical Loadings	Canonical Cross-Loadings	Redundancy Index	Canonical Loadings	Canonical Cross-Loadings	Redundancy Index
Program context variate									
Organizational fit	**–0.643**	**–0.422**		**–0.617**	**–0.391**		0.587	0.148	
Program flexibility	**–0.625**	**–0.410**		**–0.654**	**–0.415**		–0.041	–0.010	
Organizational stability	–0.296	–0.194		–0.371	–0.235		–0.511	–0.129	
Resource availability	–0.007	–0.004	0.096	–0.232	–0.147	0.1	–0.627	–0.158	0.016
Program success variate									
Delivery capability	**–0.804**	**–0.527**		**–0.867**	**–0.549**		0.141	0.035	
Organizational capability	–0.340	–0.223		–0.468	–0.297		–0.142	–0.036	
Marketing capability	–0.315	–0.206		–0.161	–0.102		–0.627	–0.158	
Innovative capability	–0.147	–0.096	0.095	–0.061	–0.038	0.1	0.753	0.19	0.016
Canonical correlation R	0.656			0.634			0.252		
R^2	0.430			0.402			0.063		
χ^2	59.251			104.419			18.937		
df	16			16			9		
$p\ (\chi^2)$	0			0			0.026		

Table 5: Results of CCA showing the impact of program contextual variables on program success dimensions: Split and total sample.

($p < 0.05$). However, Canonical R^2 of function 2 is only 0.063, coupled with low redundancy value (0.016), indicating a low practical significance. Albeit significant ($p = 0.026$), it is only of low practical relevance. Sherry and Henson (2005) suggested excluding functions with practical significance under 10%. Therefore, function 2 is not taken into consideration for results interpretation.

Comparing the canonical function based on the half sample and canonical function 1 for the total sample, they show a similar function pattern (marked with bold): that is, the canonical loadings and the canonical cross-loadings in both the program context variate and the program success variate show a similar pattern in the two canonical functions. To be more specific, organizational fit and program flexibility are shown as the two most important variables in the program context variate, with the highest canonical loadings and canonical cross-loadings in both canonical functions, while delivery capability is shown as the most important dimension in the program success variate in both functions. Beside this, the strength of association of both canonical functions, which is indicated by canonical correlation coefficients (0.656 and 0.634, respectively) and redundancy indexes (0.095 and 0.100, respectively), also show similar patterns. This provides confidence for the stability of the CCA results. Thus, the results interpretations were performed based on canonical function 1 of the total sample.

The redundancy index for the program success set and the program context set in function 1 is 0.100. Therefore, only 10% of the shared variance in program success can be accounted for by the variability in program context. This indicates a low correlation between program success and program context dimensions are not significantly different in different types of program contexts, which implies stability and generalizability of the program success measurement construct.

Discussion

In the Introduction section of this article, we conceptually positioned program success against project success. Now we can expand this to the measurement dimensions of the two concepts for success. To do that we map our program success measurement construct with some well-accepted project success measures in Table 6. The first column in Table 6 lists the measures of program success developed in our study, and the other columns present the measures of project success identified in some earlier classic studies.

	The "Iron Triangle" (Cleland & Ireland, 2002)	Pinto and Slevin (1988), Baker, Murphy, and Fisher (1988), Pinto and Rouhiainen (2001)	De Wit (1988)	Lim and Mohamed (1999)	Freeman and Beale (1992)	Wateridge (1995)	Shenhar, Dvir, and Levy (1997), Shenhar, Dvir, Levy, and Maltz (2001), Shenhar and Dvir (2007), Hoegl and Gemuenden (2001)	Turner, Zolin, and Remmington (2009)
Delivery capability • Time • Budget • Functionality • Member satisfaction • User satisfaction • Customer satisfaction • Supplier satisfaction • Sponsor satisfaction • Other stakeholders • Business results	• Time • Cost • Performance	• Time • Cost • Performance • Customer satisfaction	• Budget performance • Schedule performance • Client satisfaction • Functionality • Contractor satisfaction • Project manager/ team satisfaction	• Completion • User satisfaction	• Technical performance • Efficiency of execution • Customer satisfaction • Personal growth • Manufacturability and business performance	• Commercial success • Meet user requirements • Meet budget • Happy users • Achieve purpose • Meet timescales • Happy sponsor • Meet quality • Happy team	• Project efficiency • Impact on team • Impact on the customer • Business success	• Project output
Organizational capability • Efficient process • Organizational capability							• Preparing for the future	• Project outcome • Impact
Marketing capability • Reoccur business • Power of influence								
Innovative capability • New technology • Technology leverage								

Table 6: Mapping project and program success measures.

Table 6 shows that most project success measures overlap with program delivery capability. Only in the recent project success research (after 2007), like Shenhar and Dvir (2007), and Turner, Zolin, and Remmington (2009), did project success frameworks start to show an overlap with program organizational, marketing, and innovative capabilities.

The comparison between project success and program success indicates that to a large extent project success is focused on project deliverables, whereas program success is concerned with delivering benefits and strategies. The benefits could be tangible and intangible (Hertogh et al., 2008). Tangible benefits are represented by program delivery capability, while intangible benefits are reflected by program organizational, marketing, and innovative capabilities, as discussed in the previous section.

Delivery capability can be achieved through the aggregation of project deliverables. The other three capabilities can only be achieved through project synergies, as Blomquist and Müller (2006) indicated that one of the major responsibilities of a program manager is to identify the synergies across projects. This responsibility is far beyond project managers' work scope. The difference between project success measures and program success measures reaffirms Thiry's (2004) statement that project management is subjected to a performance paradigm, based on short-term tactical deliverables, whereas program management proves its ability to deliver strategic change or synergistic benefits. Although project success is concerned with deliverables, the measures have extended from *project management success*, which is measured against traditional performance measures, like time, cost, and quality, to *project success*, which is measured against project overall objectives, like stakeholder satisfaction and business success (Cooke-Davies, 2002; De Wit, 1988). This is in line with Jugdev and Müller's (2005) observation about the shift of project success from mere efficiency at the tactical level to also effectiveness at the strategic level. This explains why the recent research on project success (Shenhar & Dvir, 2007; Turner, Zolin, & Remmington, 2009) shows a similar pattern with program success—that is, concerning both tangible and intangible benefits.

In conclusion, the comparison between project success and program success shows that there are both similarities and differences between the two themes. Similarities include the concern for not only efficiency, but also effectiveness, while the differences refer to their subjects at different levels, that is, project success focuses on delivering project deliverables, whereas program success focuses on achieving benefits.

Conclusion

A quantitative method and web-based questionnaire was used to develop a measurement construct for program success. The construct comprises four program success dimensions derived from factor analysis. They are delivery capability, organizational capability, marketing capability, and innovative capability. The stability of the construct was tested through examining the interaction between program context and program success with ANOVA and canonical correlation analysis. The results show that neither program types nor program context characteristics significantly interact with the program success measures. Thus, the measurement construct for program success is stable at the operational level.

The research proposition is supported as we developed the four measurement dimensions and their measurement items for program success. Program context was also operationalized through two dimensions: program types and program context characteristics. In terms of program types, only two out of 16 different program types show significant differences in the four program success dimensions; in most cases (14 out of 16), program success dimensions do not significantly vary by program types. In terms of program contextual characteristics, only 10% of variability in program success dimensions can be attributed to program context characteristics, which indicates a low correlation between program success and program context characteristics (Sherry & Henson, 2005). Therefore, there is no significant interaction between program success and program context. The measurement construct for program success is stable over different types of program contexts.

The first research question in the study is answered through the identification of the measurement dimensions of program success. As to the second research question, the general answer is, to a large extent, there is no interaction between program success and program context. The managerial implications from the study are:

1. Program managers can assess program results in light of the program success measurement construct, that is, from perspectives of program delivery capability, organizational capability, marketing capability, and innovative capability. Delivery capability reflects program success from a tangible benefits perspective, whereas the other three dimensions reflect program success from an intangible benefits perspective.
2. Although program context may not directly interact with program success, it sets the managerial context for program management, and it may facilitate or hinder other factors to impact on program success. As suggested by Pellegrinelli et al. (2007), Lycett et al. (2004), and Pellegrinelli (2002), program context needs to be managed carefully.
3. As program types (like industry, size, type, and nature) are not manageable in most cases, it is usually predetermined before program set-up, program managers should put their efforts more into managing program context characteristics, which are represented by organizational fit,

program flexibility, organizational stability and resource availability.

The theoretical implications of the results are:

1. Delivery capability is shown as the most important dimension in program success. This echoes the differences between program management and portfolio/multiproject management, although they all manage multiple projects. The main focus of portfolio/multiproject management is to optimize the outcomes and resource allocation for the individual projects (Müller, 2009), whereas the main focus of program management is to deliver planned benefits or strategic objectives (Levene & Braganza, 1996).
2. The focus of project success has gradually shifted from project efficiency to project effectiveness (Jugdev & Müller, 2005); a similar trend is seen with program success. However, the subject of project success assessment is on delivering project deliverables, whereas the subject of program success assessment is on delivering organizational strategies or benefits (Thiry, 2002). Both similarities and differences between program success and project success enrich the success school of thought in the project management field.
3. The four measurement dimensions cannot be seen in isolation. All four must be addressed to measure program success. This is in line with the basic idea of systems approaches in management theory. These approaches address the interrelatedness and interdependency of the parts to the whole (Luthans, 1973).
4. The low-level interaction between program success and program context implies that program context is not a direct predictor for program success; however, it may interact with other direct predictors, such as program managers' leadership competences (Shao & Müller, 2011) to predict program success.

The strength of the study lies in the rigorous research process. From questionnaire development to data collection and data analyses, structured approaches were applied following the suggestions by methodologists. The quality check measures, such as validity and reliability, were embedded in the data analysis processes. However, a major limitation is in the questionnaire distribution method. Snowball sampling does not allow controlling questionnaire distribution by geography and industry.

Using project management professional associations, such as PMI, IPMA, and the like, to distribute the questionnaire may exclude program managers who are not associated with these organizations.

Future research could apply the measurement construct for program success in different contexts, especially those not included in this study, such as different cultures and other industries, in order to validate the construct.

The theoretical contribution of the study is the operational constructs for program success and program context. The definitions of both concepts remain at a theoretical level in the existing literature. This study might be one of the few to explore those two concepts at an operational level on an empirical basis, which enriches the theories in program management. ■

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