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Success Factors in the Management of Information Technology Service Projects in Karachi, Pakistan: A Regression, Confirmatory Factor Analysis, and Structural Equation Modeling Approach

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Abstract

Despite the extensive literature on the determinants of success in software development initiatives, those for IT services projects have been somewhat overlooked, especially in the context of Pakistan's evidence base. This study explores the variables that determine the success of IT services projects undertaken by firms in Karachi, Pakistan's major commercial and technological center. Based on the four-factor conceptual framework involving the use of agile approaches and change management, organization and people, stakeholder and risk analysis, and work environment, this research assessed the validity of these variables in relation to six criteria of success, such as quality, scope, time, cost, customer satisfaction, and provider satisfaction. The methodological triangulation adopted for this study included stepwise multivariate regression, confirmatory factor analysis, and structural equation modeling. According to the regression results, the factors affected the criteria differentially and inconsistently, with agile methodologies, change management, stakeholders, and risk analysis being the most consistent. At the same time, organization and people had a greater impact on the satisfaction criteria. The confirmatory analysis supported the use of the four-factor structure. The structural model confirmed that the work environment indirectly affected overall success, specifically through its impact on the organization and its people. Thus, the success of projects involving IT services in Karachi seems to be contingent on the combination of agile and traditional approaches, as well as investments in personnel and risk management focused on stakeholders.

Keywords: project management success, IT service projects, structural equation modeling, agile methodologies, critical success factors, Pakistan

1. Introduction

The question of why some projects succeed and others do not has been an important topic in project management, especially in IT. Initial explorations into the causes of project failure were undertaken by the Standish Group (1995), which highlighted the relatively high rate of software project failure. This was followed by a series of empirical studies that clarified the specific elements that distinguish project failures from successes (Besner & Hobbs, 2006; White & Fortune,2002). However, further research into project management revealed that success itself is not a monolithic concept but a multifaceted one (Atkinson, 1999; de Wit, 1988; Ika, 2009).
In this emerging debate, an important distinction can be drawn among IT software production, IT system integration, and IT services, each with distinct principles of delivery and risks. The criteria

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for success in IT service delivery projects – in which the supplier provides continuous or bounded technical services to the client organization – have attracted far less systematic attention than those for IT software development projects (Zalesk & Michalski, 2021). Such comparative oversight is significant not only because of the particularities inherent in IT services delivery but also because of the different nature of project delivery contexts, such that what works in one setting does not necessarily work in another.

Moreover, the gap widens further when one shifts focus to emerging markets such as Pakistan, where an increasing number of information systems projects are underway. The IT and IT-enabled services sector in Pakistan has witnessed rapid growth in recent years. As Karachi is Pakistan's largest city and leading commercial hub, it is home to many software houses, business process outsourcing companies, and consulting firms that serve both national and international markets. Despite this significance, there has been limited empirical work on the determinants of project management success in such situations, and even fewer studies in Pakistan have focused solely on information systems projects. Most studies in Pakistan either use a mixed sample in which information systems projects constitute only a very small part (Irfan et al., 2019) or, when they do consider IT projects, focus on narrower issues, such as scope creep (Komal et al., 2020).

To address this research gap, the current study adopts an existing model of four factors contributing to success in IT service project management. It analyses its applicability in the Karachi context using multivariate statistical techniques. These four factors include agile methodology and change management, organization and people, stakeholders and risk analysis, and work environment, which are subsequently analyzed according to six criteria that contribute to the overall assessment of the level of success achieved by the project. Three major objectives are guiding the investigation. The first aims to identify, through stepwise multivariate regression, the factors that contribute significantly to explaining each of the six criteria. The second objective is to confirm the four-factor measurement model using confirmatory factor analysis. Lastly, a structural equation model involving the four factors and a general measure of project management success is developed and validated.

In summary, the contributions made by this study are both substantive and methodological. First, in terms of substance, this research is the first attempted evelopanall-encompassing, locally validated model of IT project service success in Karachi. Second, the present study provides a methodology in which three approaches, namely regression, confirmatory factor analysis, and specification search-driven structural models, are employed together in one framework of exploration; this methodological approach, although rare in the IT project management field, is even more so when related to Pakistan, and can prove to be quite valuable. The rest of the paper is dedicated to reviewing the relevant literature, data sources, and analysis procedures used; presenting findings and discussing them from both theoretical and practical perspectives; identifying limitations; and suggesting future work.

2. Literature Review

2.1 Conceptions of Project Management Success

Analysis of the antecedents of success cannot begin without first deciding what success is, and again, there is no consensus in the literature. According to the classical definition, success was defined in terms of delivery on schedule, within budget, and in accordance with specifications.

However, de Wit (1988) and Atkinson (1999) convincingly argue that this definition applies to project management success rather than to success as a whole, because it ignores whether the project produces benefits for its stakeholders. It was Baccarini (1999) who clearly defined the two concepts: project management success and product success. Ika (2009) later showed how many criteria of success emerged in the project management literature. This proposed model takes into

account both aspects of success mentioned above by incorporating all four classic criteria (quality, scope, time, cost) plus two new dimensions (customer satisfaction and provider satisfaction), which are very important in service projects because the opinions of both parties may influence future cooperation.

The multidimensional notion of success thus entails a certain implication from a research-methodology perspective: since the measures are conceptually independent, the determinants need not be the same for both; in fact, something critical to the attainment of one measure may be entirely irrelevant to the other. This approach, taken by the current study, follows from this basic idea.

2.2 Critical Success Factor Studies in IT Projects

A significant body of literature has been devoted to identifying and testing the key success factors for agile and IT projects. Specifically, the survey study by Chow and Cao (2008) identified six success factors, ranging from agile software development methodology, project delivery method, project management process, team capability, customer participation, and team atmosphere, based on a broad array of candidate factors. This framework was used in various contexts, including Stankovic et al.'s (2013) study of firms in the former Yugoslavia. However, this attempt had severe limitations due to the very small sample size and the lack of statistical significance in the model under test. Nevertheless, both studies indicated that agile and human-related factors tend to emerge as candidate predictors, but there were significant variations regarding which factors became statistically significant.

An apparent shortcoming in many of these previous studies is the use of regression equations that either include insignificant variables or fail to perform stepwise re-estimation after eliminating them. Since interrelationships among predictor variables can render a coefficient insignificant when a related predictor is deleted, the lack of stepwise re-estimation raises questions about certain previously drawn conclusions. This study attempts to remedy this problem by using forward, backward, and best-subset stepwise re-estimation, along with only significant predictors.

2.3 Structural Equation Modeling in Project Success Research

Structural equation modeling (SEM) has become popular in studies aimed at understanding project success for its ability to incorporate factors such as latent variables, measurement errors, and the analysis of complex, interrelated variables (Hair et al., 2009; Kline, 2005). In the case of the former, most applications have focused on the construction sector and looked into the effects of sustainability, risks, and stakeholder relations on performance. SEM applications in IT project management have been rare compared to other disciplines and also vary greatly in the constructs used and purposes served.

According to Tam et al. (2020), the factors influencing successful IT projects included stakeholder input, individual attributes, society, and team competence, with the last two having no direct bearing on success. The factors affecting software success, according to Hamid et al. (2022), included planning, human resources, time estimation, and cost estimation. However, Fakhkhari et al. (2021) developed their factors based on a frequency analysis of the existing literature rather than on empirical measurements. Recent academic research has further contributed towards refining the notion and measurement of IT and IS project success (Nyman & Oorni, 2023; Santos & Varajao, 2024), whereas the perennial issue of how beneficial the agile development approach is in terms of success has been statistically assessed by Serrador and Pinto (2015), who provided ample evidence for the effectiveness of agile methodology depending on context.

2.4 Pakistan-Based Research

Pakistan-based research studies remain few and are usually not limited to information technology-related topics. For example, in their research, Irfan et al. (2019) investigated how project management maturity influenced project success using a non-IT project sample that constituted only a minority in their mixed-industry case study, limiting the applicability of their findings to the IT services sector. Another Pakistan-based study by Komal et al. (2020) focused on the effect of scope creep on software project success in the country, but reported low structural effect coefficients, possibly because their specification lacked any indirect links.

The work by Muhammad et al. (2021) showed, in the context of Pakistan's IT industry, that agile management resulted in higher project success, and that this linkage is partially mediated and moderated by leaders' competencies. In contrast, Wafa et al. (2022) established that agile software development and professional's fit on their job contributed to success with respect to all of its aspects—cost, quality, time, and satisfaction of the stakeholders. Zaman et al. (2022) also identified the link between project management innovations, project governance, and high-performance work practices, resulting in project success, using structural equation modeling.

Even though there have been more empirical contributions in the context of Pakistan regarding the roles of agility and humans, none of these investigations used exploratory approaches; rather, they followed confirmatory, hypothesis-driven designs, failing to explore alternative structural models. At any rate, the current body of knowledge does not include research identifying the set of service-oriented success factors/criteria for Karachi, and even less so an investigation that explores the space of plausible structural configurations.

2.5 Hypotheses

While the methodological approach adopted for this study is largely exploratory, it is possible to formulate directional predictions based on the conceptual framework and existing literature. The hypotheses are outlined below. These propositions organize the inquiry without constraining the structural search to a single predetermined configuration.

Concerning the direct determinants of success, it is proposed that

H1 agile techniques and change management positively influence IT service project management success,

H2 organization and people positively influence IT service project management success, and that

H3 stakeholders and risk analysis positively influence IT service project management success.

Concerning the structural relationships among the factors themselves, it is further proposed that

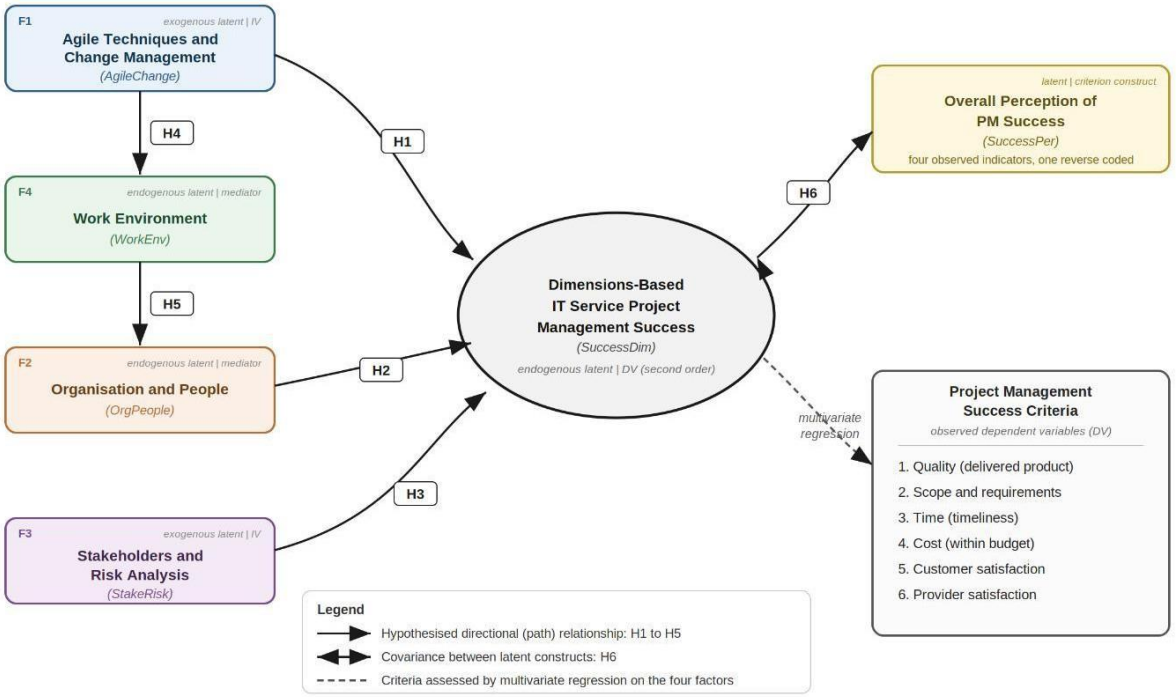
H4 agile techniques and change management positively influence the work environment, and that

H5 the work environment, in turn, positively influences organization and people, so that the work environment exerts an indirect rather than a direct effect on overall success.

Finally, with respect to the criterion construct, it is proposed that H6: the dimensions-based success construct is positively and significantly associated with managers' overall perception of project management success. These six hypotheses are revisited in light of the empirical results in the discussion that follows the analysis.

2.6 Conceptual Framework

Fig. 1 Conceptual Framework



Note. Conceptual framework adapted from Michalski and Zaleski (2024) and Zaleski and Michalski (2021).

Variable types: rounded rectangles and the central ellipse are latent (unobserved) constructs; the numbered list comprises observed (measured) variables.

IV = independent variable; DV = dependent variable. WorkEnv and OrgPeople are endogenous latent constructs that also serve as mediators.

Hypotheses: H1 to H3, factors to success; H4, AgileChange to WorkEnv; H5, WorkEnv to OrgPeople; H6, success construct with overall perception.

3. Method

3.1 Context and Sampling

The empirical context of this study pertains to the IT services sector in Karachi, Pakistan. In Karachi, one can find numerous software houses, IT-enabled service providers, and consultancy firms that provide IT services, including application development, system maintenance, cloud migration, quality assurance, and managed services to clients. The clients are not only from Pakistan but also from other countries.

Data were gathered via a survey of seasoned project managers, who were asked to complete it based on their knowledge of an IT service project that had just been completed. The survey utilized purposive sampling because the population being studied, i.e., those responsible for ensuring the successful completion of projects, is specialized and cannot be easily sampled from any public list. Following the elimination of all incomplete and discrepant responses, data were analyzed based on 178 valid questionnaires. The obtained sample was reasonably balanced in terms of gender and experience, with participants having an average tenure of over nine years in the IT field and over six years as project managers. Though the lack of randomness in the sample constrains generalization, the sample's size and homogeneity are quite competitive with those of similar international studies and lend substantial validity to its findings for Karachi.

3.2 Instrument

The questionnaire operationalized the four success factors and six success criteria using questions drawn from validated measures, appropriately modified for use in Pakistan's IT services industry. The factors of agile techniques and change management were addressed through questions about training in the agile approach, work-in-progress constraints, a focus on outcomes rather than usage, control of change requests, and proper documentation. The organizational and people factors were covered using questions about executive support, organizational structure, team members' technical skills, and team motivation. Stakeholders and risk analysis were determined using questions on the priority delivery of the most important features, risk assessment at every change and at every control point, and stakeholder impact analysis. Finally, the work environment included questions on cloaca, features of the workspace, and team autonomy.

For each variable, respondents provided a seven-point Likert-scale response from strongly disagree to agree strongly. The six success indicators were also rated directly by the project managers. At the same time, four other variables were used to gauge the projects' overall success and the prospects for future success, based on achievements, winning more jobs, and, finally, a reverse-coded statement indicating that no success had been achieved whatsoever. The reverse-coded statement was used to minimize acquiescence bias. The questionnaire was pre-tested by relevant experts in the field.

3.3 Analytical Procedures

The analyses were carried out using recognized statistical and covariance structure software tools. The regressions, reliability, and exploratory analyses were undertaken in IBM SPSS Statistics version 29 and TIBCO Statistical version 14. In contrast, the confirmatory factor analysis and the structural equation models were estimated in IBM SPSS Amos version 29. As not specified otherwise, the usual significance level of .05 was taken into account, and the significance tests of the parameters were carried out with respect to their null hypothesis values equal to zero. In general terms, the multivariate linear regression model for a given success criterion on the four identified factors can be expressed by the equation:

$$\mathbf{Y = b_0 + b_1(}\boldsymbol{AgileChange}\mathbf{) + }\boldsymbol{b_2}\mathbf{(OrgPeople) + b_3(}\boldsymbol{StakeRisk}\mathbf{) + }\boldsymbol{b_4}\mathbf{(WorkEnv) + Error}$$

where Y is the dependent success criterion variable, and b are the coefficients of the regression line. For all criteria, stepwise forward, backward, and best-subset analyses were conducted to determine the most reliable specifications of the relationships, and the standardized beta coefficients were utilized to compare their magnitudes.

Four-factor measurement validation was conducted by means of confirmatory factor analysis, where the fitness of the model was assessed via the chi-square statistic to degrees of freedom ratio, the incremental fit index (IFI), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA), assisted by composite reliability, Cronbach's Alpha, and standardized alpha. Four factors were next incorporated into the structural model, including the higher-order dimension-based concept of success and overall success perception. Parameter estimation was performed using the maximum likelihood method, and significance levels for the parameters were assessed using a bootstrap approach with 500 replications. Competing models were contrasted using Akaike and Bayesian information criteria, in addition to the aforementioned fit indices.

In keeping with the exploratory nature of this research, the modeling approach was driven by data rather than strictly guided by hypotheses. The hypotheses mentioned above provide general ideas about the direction of effects and their existence, but they did not impose any particular structure on the model from the outset. Given that various structures of the same qualitative type could meet

more than one criterion statistically, forcing each relationship based on fixed hypotheses could oversimplify the phenomenon and yield conflicting conclusions across different models, all equally valid. Thus, the objective was to build models that both provided a good fit and were theoretically easy to interpret, fine-tuning them in accordance with fit indicators and the significance of estimates, in line with the original theory (Michalski & Zaleski, 2024).

4. Results

4.1 Multivariate Regression Models

Regression analyses were conducted to identify which success factors significantly explained any of the six success criteria, and the findings indicated a selective rather than universal influence of these factors, as presented in Table 1. In relation to the quality criterion, a significant model, accounting for about twenty-seven percent of variance, included such factors as agile, change management, organisation and people, as well as stakeholders and risk analysis, whereby agile demonstrated the highest level of standardized influence while organisation and people showed the least of the three; it should be noted that the work environment variable did not make it into the model at all, indicating that managers in Karachi failed to correlate the quality delivered with workspace conditions. In respect of scope, the most difficult criterion to explain, an insignificant model could only include stakeholders and risk analysis as a single marginally significant predictor.

The timeliness criterion presented a contrasting picture, as it was the only criterion explained by all four factors, with work environment, organisation, and people the most influential, and the agile and stakeholder factors somewhat less so. However, the comparability of the coefficients implies that all four contributed materially to on-time delivery. The cost criterion was explained by only two factors, agile techniques and change management and work environment, with similar standardized weights and a small explained variance that invites further investigation. The two satisfaction criteria behaved similarly and yielded the strongest models: customer satisfaction and provider satisfaction were each explained by agile, organisation, people, and stakeholder factors, with organisation and people the dominant influences in both, and the provider satisfaction model achieving the highest explained variance of all six criteria. Across the set, agile techniques and change management, stakeholders, and risk analysis appeared in five of the six models, organisation and people in four, and work environment in only two, a configuration that foreshadows the indirect role of work environment subsequently revealed by the structural model.

Table1Summary of Stepwise Multivariate Regression Models for the Six Success Criteria (N= 178)

Criterion	Significant predictors (standardized beta)	R squared	F (df)	p
Quality	Agile (.37), Stake (.30), OrgPeople (.16)	.27	21.4(3, 174)	<.001
Scope	Stake(.13)	.02	3.10(1, 176)	.080
Time	WorkEnv (.27), OrgPeople (.24),Agile(.16),Stake(.15)	.18	9.42(4, 173)	<.001
Cost	WorkEnv(.21), Agile(.18)	.07	6.85(2, 175)	.001
Customer satisfaction	OrgPeople (.37), Agile (.33), Stake(.33)	.35	31.2(3, 174)	<.001
Provider satisfaction	OrgPeople (.43), Agile (.37), Stake(.34)	.44	45.6(3, 174)	<.001

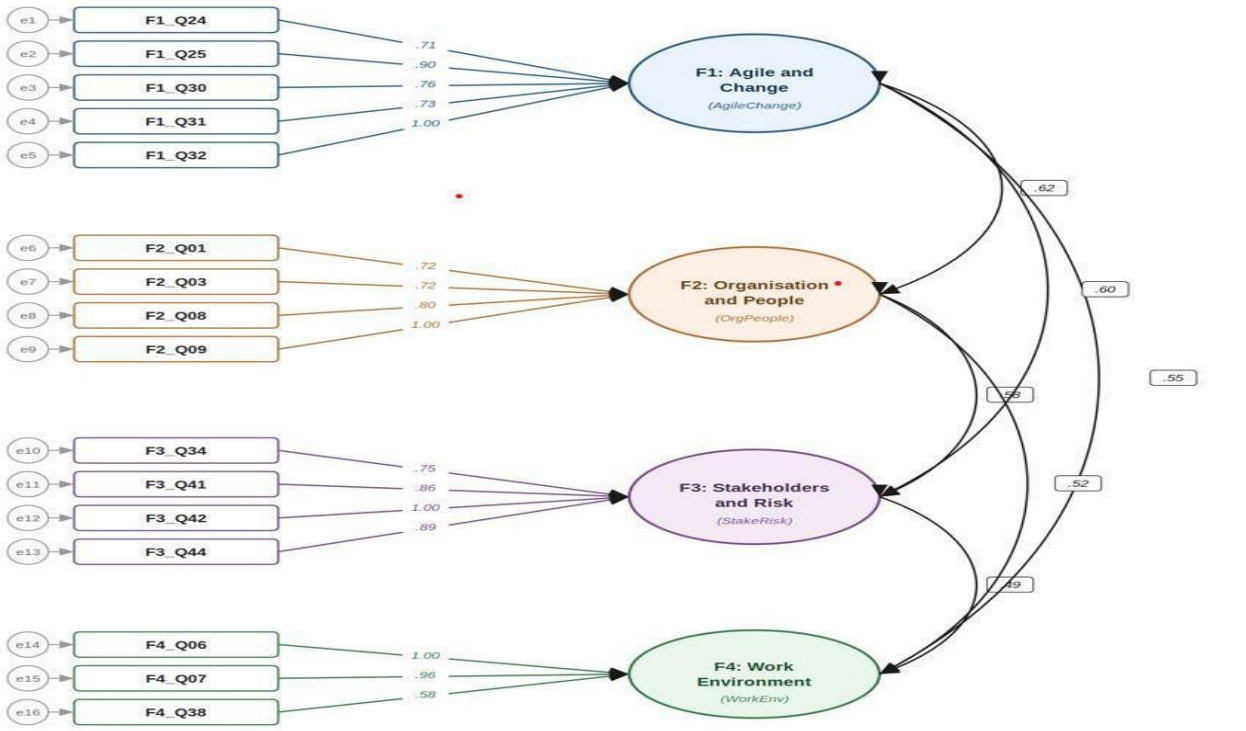
Note. Agile = agile techniques and change management; OrgPeople = organization and people; Stake = stakeholders and risk analysis; WorkEnv = work environment. Standardized beta coefficients appear in parentheses.

4.2 Confirmatory Factor Analysis

Having established the regression relationships, the analysis turned to validating the measurement structure on which the subsequent structural model would rest. A factor analysis model was formulated on the basis of four latent factors and their items, resulting in fit indices that, when combined, demonstrated a satisfactory fit between the structure proposed by the theory and the data obtained, as presented in Table 2. Chi-square/degrees-of-freedom ratio was considerably lower than the commonly accepted maximum value; both incremental fit indices were higher than the common benchmark value of .90; RMSEA was closer to a more stringent index criterion than the other indicators used in the study.

The examination of reliability and validity continued with composite reliability, the alpha coefficient, and its standardized version, and average variance extracted; the results are presented in Table 3 below. In this respect, composite reliability was above the required threshold for all four variables; the alpha coefficients were adequate to very good; the average variance extracted met the .50 requirement for convergent validity; and the work environment factor had the lowest reliability among the other factors. The overall perception of success construct, measured by four items, demonstrated strong reliability and convergent validity, which justified its inclusion as the criterion construct in the structural model.

Fig 2. Confirmatory Factor Analysis Measurement Model of the Four Success Factors



Note. Standardised estimates. Single headed arrows are factor loadings; curved double headed arrows are inter factor covariances; e1 to e16 are measurement errors.
Model fit: chi square = 142.0, df = 98, chi square/df = 1.449, IFI = .945, CFI = .943, RMSEA = .050. All loadings significant at p < .001; all covariances at p < .005.
Adapted from Michalski and Zaleski (2024) and Zaleski and Michalski (2021).

Table2. Fit Indices for the Confirmatory Factor Analysis Model

Chi square	Df	p	Chi-square/df	IFI	CFI	RMSEA
142.0	98	.002	1.449	.945	.943	.050

Note. IFI=incremental fit index; CFI=comparative fit index; RMSEA=root mean square error of approximation.

Table3. Reliability and Convergent Validity of the Latent Constructs

Construct	CR	Alpha	Std. alpha	AVE
Agile techniques and change management	.84	.80	.80	.51
Organization and people	.85	.83	.83	.59
Stake holders and risk analysis	.83	.78	.78	.55
Work environment	.76	.65	.66	.53
Overall perception of success	.90	.86	.86	.70

Note. CR = composite reliability; Std. alpha = standardized Cronbach's alpha; AVE = average variance extracted.

Structural Equation Models

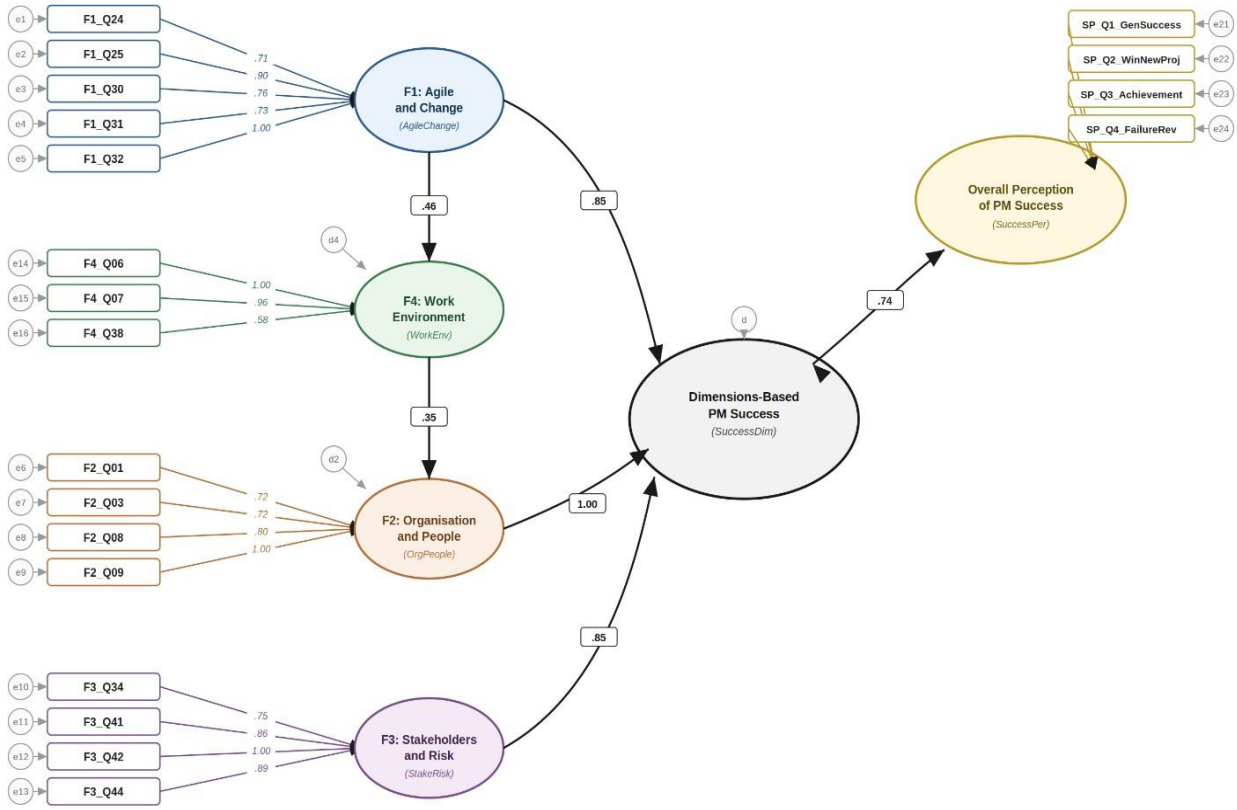
The structural analysis began with an initial model that treated the four factors as orthogonal contributors to a dimensions-based success construct, which in turn was allowed to covary with the directly measured overall perception of success. This initial specification fitted the data adequately and confirmed a strong, significant association between the factorial structure of success and managers' overall subjective appraisal. However, its assumption of orthogonality was theoretically restrictive, since the four factors are plausibly interrelated. The fit indices for this initial model are reported in the upper portion of Table 4.

To relax the orthogonality assumption, a specification search was conducted over the space of plausible relationships among the four factors, with the link between work environment and the higher-order success construct treated as optional, given its comparatively weak direct contribution. The evaluation of the search relative to both the information criteria and the fit indices suggested a structure in which the work environment variable did not have a direct relationship with any of the dimensions of the success construct, but rather exerted its effect through other variables. After removing a non-significant and conceptually problematic path and comparing several potential directional models, it emerged that the chosen model consisted of agile techniques and change management impacting the work environment, work environment impacting the organization and people, and agile techniques, change management, stakeholders, and risk analysis having high direct impacts on the success construct. The fit statistics associated with this final model, shown below the diagonal section of Table 4, were better than those of the original orthogonal model with respect to all criteria, and all paths were significant at the .01 level.

The standardized path coefficients for the final model are provided in Table 5, while the direct and indirect effects are presented in Table 6. Both the fit indices and the structure's interpretability are acceptable. Although the work environment did not affect overall success, its indirect effect, mediated through organization and people, was not insignificant, thus corroborating the idea that the work environment defines the conditions for people and the organization rather than contributing to success directly. Taken together, the paths between agile techniques and change management, and between work environment and organization and people, form a clear chain in which the implementation of agile methods determines the nature of the work environment and further affects the organization and people's behavior. In addition, both the higher-order success

concept and organization and people were positively loaded by agile techniques and change management. It is noteworthy that the factor was the only one of the four factors to have an effect through two distinct paths: one direct and another indirect through the work environment. The significant covariance between the dimensions-based success construct and the overall perception of success, retained at the .01 level, provides additional evidence of the validity of the measured structure.

Fig. 2 Final Structural Equation Model of Success Factors in IT Service Project Management



Note. Final structural model [Model 35(6 mod)], standardised estimates (N = 178). Single headed arrows are directional paths; the double headed arrow is a covariance.
Work environment has no direct path to success; its effect is indirect through organisation and people. e1 to e24 are measurement errors; d, d2, d4 are structural disturbances.
Model fit: chi square = 238.0, df = 164, chi square/df = 1.451, IFI = .942, CFI = .941, RMSEA = .050, AIC = 330.0, BIC = 470.2. All paths p < .01; covariance p = .002.
Adapted from Michalski and Zaleski (2024) and Zaleski and Michalski (2021).

Table4. Fit Indices for the Initial Orthogonal and Final Structural Equation Models

Model	Chi square	df	Chi sq/ df	RMSEA	IFI	CFI	AIC	BIC
Initial orthogonal	252.0	165	1.527	.055	.930	.929	342.0	480.1
Final (work environment indirect)	238.0	164	1.451	.050	.942	.941	330.0	470.2

Note. AIC = Akaike information criterion; BIC = Bayes information criterion. Lower values of AIC and BIC indicate a more parsimonious fit.

Table5. Standardized Path Coefficients for the Final Structural Model

Structural path	Coefficient	SE	p
Agile techniques and change management for the success construct	.84	.15	.006
Stake holder sand risk analysis for the success construct	.85	.15	.004
Organization and people to success construct (reference)	1.00		
Agile techniques and change management in the work environment	.46	.13	.005
Work environment to organization and people	.35	.11	.005
Success construct with overall perception (covariance)	significant		.002

Note. SE = standard error. The reference indicator was fixed to scale the latent construct. Coefficients were estimated using maximum likelihood, with statistical significance assessed via bootstrapping (500 replications).

Table6 Combined Total Effects on the Dimensions-Based Success Construct

Factor	Direct effect	Indirect effect	Total effect
Agile techniques and change management.	.84	(via work environment) .88	
Stake holders and risk analysis	.85		.85
Organization and people	1.00 (ref.)		1.00
Work environment		.39	.39

Note: All observed effects were significant at p< .01. The indirect effect of the work environment is mediated by organization and people.

5. Discussion

The results further contribute to the body of knowledge on the determinants of IT service project success as applied in the Karachi setting, confirming and refining existing theory on the issue. Specifically, the regression analysis confirms that the four independent variables affect the six dependent measures differently, a finding consistent with Atkinson's (1999) and de Wit's (1988) multidimensionality-of-success hypothesis. The significance of agile techniques and change management measures for five of the six models is worth highlighting, especially when considered against the background of prior replications of the Chow and Cao (2008) research design, such as that by Stankovic et al. (2013). These authors found, quite unexpectedly, that the agile measure was insignificant even though they used agile methodologies in their projects. For the Karachi sample, in comparison, the agile techniques and change management variable is one of the most frequently occurring predictors, appearing in five out of six regressions, including being statistically significant at $p < .001$ in specifications for the quality, customer satisfaction, and provider satisfaction measures, potentially indicating a more mature use of agile approaches in the Karachi setting, among other things.

The roles of organization and people in accounting for satisfaction criteria should be emphasized, as these factors are relevant in the context of Karachi's labor market dynamics. The strongest predictor of satisfaction in both models under analysis, the organizational people factor, had a significance level of $p < .001$ and standardized weights of .37 and .43 for client and service provider satisfaction, respectively. Indeed, the high competitiveness and mobility of Karachi's

labor market for engineers may explain why the competence, motivation, and executive support inherent in this context correspond to the participants' perceived relationship satisfaction. The current finding is consistent with the findings of Tam et al. (2020), who used team capability to account for project success. Further evidence from Pakistan shows that the match between job fit of professionals and agile delivery can contribute to project success in terms of cost, quality, time, and stakeholder satisfaction (Wafa et al., 2022). Moreover, the ability of agile management techniques to enhance project performance through leadership factors (Muhammad et al., 2021) seems to underscore the importance of organizational people for project success.

The structural model's most theoretically interesting result is the indirect role of work environment. Rather than driving success directly, work environment operates through organization and people, a pathway whose coefficient was significant at $p = .005$ (standardized weight = .35) and that makes intuitive sense once it is recognized that the physical and organizational conditions of work, including co-location, communal space, and team autonomy, shape how people collaborate and how they perceive organizational support rather than producing outcomes on their own. The upstream influence of agile techniques and change management on the work environment, itself significant at $p = .005$ (standardized weight = .46), further indicates that the adoption of agile philosophy reshapes the team's workspace and autonomy, a relationship that echoes one of the central tenets of the Agile Manifesto and that has practical resonance in Karachi firms transitioning from traditional to hybrid delivery models. That agile techniques and change management also loaded directly on the higher-order success construct at $p = .006$ and, uniquely among the factors, contributed through both a direct loading and an indirect path by way of the work environment, reinforces the view that it is a foundational determinant through which the influence of other factors is partly channeled. In contrast, the covariance between the dimensions based on the success construct and the overall perception of success, significant at $p = .002$, attests to the validity of the measured structure.

For practitioners managing IT service projects in Karachi, several implications follow. The evidence supports continued investment in the knowledge and skills of project teams and in cultivating intrinsic commitment alongside material reward, since organization and people consistently shape the satisfaction outcomes that sustain client relationships. It supports the disciplined application of agile and change management practices, not in isolation but in combination with traditional controls, given that the most explanatory models drew on both traditions and given quantitative evidence that agile delivery reliably, if modestly, improves project success (Serrador & Pinto, 2015). It also supports a stakeholder-centered approach to risk, conducted at every change and at defined control points, since stakeholders and risk analysis were a recurrent and significant predictor across the criteria. Finally, the indirect influence of the work environment implies that improvements to the workspace and team autonomy are best understood as enabling conditions whose benefits materialize through their effects on people and the organization. This nuance should inform how such investments are justified and evaluated.

Taken together, the results allow each of the stated hypotheses to be reassessed against exact significance values. The evidence supports H1, since agile techniques and change management loaded positively and significantly onto the dimensions-based success construct at $p = .006$ and were significant at $p < .001$ in the quality, customer satisfaction, and provider satisfaction regressions. The evidence supports H2, since organization and people were positive and significant predictors of success, with $p < .001$ in both the customer satisfaction and provider satisfaction models. The evidence supports H3, as stakeholders and risk analysis loaded onto the success construct at $p = .004$ and recurred as significant predictors across the criteria. The structural pathways support H4 and H5, given the significant link between agile techniques and change management and the work environment ($p = .005$), and the subsequent significant link from the work environment to organization and people ($p = .005$). This chain confirms an indirect, rather than direct, influence on the work environment. Finally, the significant covariance between the

dimensions based on the success construct and managers' overall perception of success, obtained at $p = .002$, supports H6. The pattern, therefore, corroborates the model's directional expectations while reserving the precise structural configuration for the data-driven search described earlier.

5.1 Limitations and Future Research

Limitations of these findings include areas for future research that they indicate. First and foremost is the purposeful nature of the selected sample, large and homogeneous though it may be, which limits generalizability beyond the IT services sector in Karachi. Future studies should seek to validate the model using probability samples and across other Pakistani technology centers to establish the geographic reach of the findings. A second limitation is the cross-sectional design, which captures perceptions at a single point in time and therefore cannot adjudicate the temporal ordering implied by the structural paths; longitudinal designs would permit stronger causal inference and illuminate how the determinants of success evolve over a project's life.

A third limitation concerns the treatment of the success criteria as directly measured single items rather than as latent constructs with multiple indicators, a simplification that future work could relax by modeling quality, scope, time, cost, and the two satisfaction dimensions as multi-item latent variables. The short-term framing of satisfaction is a related constraint, since the present design does not capture how customer and provider satisfaction develop after delivery; incorporating a longer-term perspective would be especially valuable for service projects, in which the continuation of the relationship is consequential. Methodologically, subsequent research might complement the survey approach with qualitative methods or techniques for eliciting the relative importance of factors, such as pairwise comparisons, to triangulate the present findings and deepen the interpretation of the structural relationships.

6. Conclusion

This study set out to model the determinants of IT service project management success in Karachi, Pakistan, a setting of considerable economic importance but limited prior empirical attention. Using a modification of the well-known four factors framework and its application through triangulation via stepwise regression, confirmatory factor analysis, and structural modeling, the study provides a robust and parsimonious explanation of the way agile approaches and change management, organizational and human factors, stakeholder and risk analysis, and working conditions affect six aspects of success as well as managers' general perception thereof.

The main finding is that success in this context is determined by the blend of agile and conventional approaches, investment in human resources, and a stakeholder-focused approach to risk management. At the same time, the work environment is treated as a facilitative variable that indirectly affects success. The methodological lesson learned from this study is that the careful yet exploratory use of regression analysis, confirmatory methods, and structural equation modeling provides an excellent research design that has not been utilized extensively within the body of knowledge on IT project management and could prove useful for studying similar phenomena in IT and beyond. While the conclusions are bounded by the sampling and design limitations acknowledged above, the validated model provides both a practical guide for project managers in the Pakistani IT services sector and a foundation for the comparative and longitudinal research that the field now requires.

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