Strategic Information Systems Planning Success:

Refinement of Segars and Grover's Measurement Model

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Abstract. Segars and Grover recently provided a refreshingly ambitious and rigorous example of instrument construction in their article developing a measure of Strategic Information System Planning (SISP) success. Their attention to the theoretical and research foundations of the construct combined with an extensive process of validating the initial item set should be viewed as a model for future instrument development efforts. Though exemplary in many ways, their approach in the use of covariance structure methods in finalizing the instrument presents several problems. This article presents a further refinement of their instrument for measuring SISP success by applying both traditional and contemporary guidelines to the use of covariance structure methods. In presenting our refinement, we address issues of scale unidimensionality, reflective versus formative variable types, model fit, model complexity, and the requisite sample sizes for evaluating complex models. The findings apply not only to future refinement and validation of SISP-related measures, but generalize to instrument development efforts across the full spectrum of MIS-related constructs.

Keywords. IS strategic planning, measures, planning effectiveness, second-order factor modeling, structural equation modeling

ISRL categories. AI0611, EF02, EF04, EI0225

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> "Man, as the minister and interpreter of nature, does and understands as much as his observations on the order of nature, either with regard to things or the mind, permit him, and neither knows nor is capable of more."
>
> — Sir Francis Bacon, *Aphorisms on the Interpretation of Nature and the Empire of Man*

> "Every tub must stand upon its bottom."
>
> — Charles Macklin, *The Man of the World, Act 1, Scene 2*

INTRODUCTION

Research meant to uncover and test complex relationships among constructs depends critically on valid and reliable measures of concepts. Bagozzi and Phillips (1982) highlighted the interdependence of measurement and causal assessment when they argued for a *holistic* approach to building and testing organizational theories. In particular, they pointed to the manner in which contaminated measures can attenuate and distort causal relationships. Thus, theories can hardly be assessed in the context of poorly measured constructs.

Within the field of information systems research, the state of construct measurement has been particularly disconcerting. Straub (1989) reviewed 117 empirical MIS studies from three journals (*MIS Quarterly*, *Communications of the ACM,* and *Information and Management*) over a three-year period. Across all forms of validity assessment methods, reliability was the most frequently used form — with a mere 16% of all studies reporting evidence of reliability. Sethi and King (1991) offered equally dismal findings on the low level to which MIS measures exhibited ongoing and cumulative improvement in the research literature. The authors reviewed major empirical studies in ten major IS research areas and found only one construct — namely, user information satisfaction — in which researchers had devoted cumulative effort to developing and validating measurement instruments.

There may be early signs, however, of a renewed attention toward the validation and ongoing improvement of measures within the IS research community. A large body of recent work has focused on the measurement of information system service quality (Kettinger et al. 1995; Kettinger and Lee 1997; Pitt et al. 1995; Van Dyke et al. 1997; Watson et al. 1998). Recently edited collections address the measurement of information systems success (Garrity and Sanders 1998) and information technology investment payoff (Mahmood and Szewczak 1999). Work continues to be done on user involvement, user participation, and user satisfaction (Amoako-Gyampah and White 1993; Barki and Hartwick 1994; Doll et al. 1994; Doll et al. 1995; Hendrickson et al. 1994; Lawrence and Low 1993; Iivari and Ervasti 1994; McKeen et al. 1994; Torkzadeh and Doll 1994). Other key areas in which measurement issues have been addressed include: Electronic Data Interchange (EDI) usage (Massetti and Zmud 1996), computer self-efficacy (Compeau and Higgins 1995), persons' concerns regarding organizational information privacy (Smith et al. 1998), and perceived usefulness and ease of use (Adams et al. 1992; Chin and Todd 1995; Davis 1989; Segars and Grover 1993; Subramanian 1994).

One of the most ambitious attempts to provide solid grounding for instrument development was provided by Segars and Grover (1998). In developing a measure of Strategic Information Systems Planning (SISP) success, the authors conducted an exhaustive literature review, developed survey items, and performed a series of validation procedures. The present study extends their work by offering a refinement of the SISP success measure. First, Segars and Grover's analysis is reviewed and their resulting measurement model examined in some detail. Second, some important considerations in measurement theory and the application of covariance structure techniques is discussed, pointing to several limitations of Segars and Grover's final model. Next, a modified measurement model is offered and its fit assessed by applying confirmatory factor analytic methods to Segars and Grover's original data. Finally, the present findings are discussed and suggestions offered for further refinement and validation of the SISP success measure.

SEGARS AND GROVER: MEASURING SISP SUCCESS

Segars and Grover begin by providing an extended theoretical foundation for the operationalization of SISP success. Based on their review of the literature, they identify four approaches to measuring the success of strategic IS planning efforts. The first approach involves *goal-centered judgment* and addresses the question, "To what extent have planning goals been achieved?" A second approach looks at success as a *comparative judgment,* asking, "Does the system performance within this organization compare favorably with similar/comparable organizations?" A third approach applies a *normative judgment* standard, in which an organization's system performance is evaluated against an ideal, regardless of the specific goals of the organization. Finally, one can assess success through *improvement judgment*, with success defined on the basis of the planning system's ability to adapt over time to changing demands and conditions. Segars and Grover eventually settle upon the goal-centered and improvement approaches as the theoretical foundation for their operationalization efforts, noting that "collectively, these perspectives represent the 'ends' (the output of the planning system) and 'means' (adaptability of the process) view for evaluating planning system benefits and, as important, are consistent with much of the evaluation literature within SISP. . . .” [p. 142].

Acknowledging the underlying complexity of SISP (DeLone and McLean 1992), Segars and Grover offer a multidimensional conceptualization of the construct. They examined over 150 articles garnered from 11 leading journals for content addressing SISP effectiveness. From their review, 50 distinct strategic IS objectives were identified. The authors submitted the collection of objectives to a group of “experts,” who suggested adding, discarding, or combining objectives. After this validation effort, 28 objectives remained. The 28 objectives were then grouped first by the authors and then independently by a panel of experts, resulting in three key dimensions: *alignment* of IS and business strategy, *analysis* of the organization’s internal operations, and attainment of *cooperation* with respect to development priorities, implementation timelines, and managerial responsibility. To these three dimensions, Segars and Grover added a fourth — *improvement in capabilities* — designed to capture the capability of the planning system to adapt to changing conditions and circumstances. The final step in item construction involved conversion of each objective and construct definition to statements that could be used in a Q-sort procedure. On the basis of the Q-sort results, 23 of 28 objectives were retained representing the alignment, analysis, and cooperation dimensions. Segars and Grover operationalized the improvement in capability dimension with seven items based upon prior validation work by Venkatraman and Ramanujam (1987), and Raghunathan and Raghunathan (1994). Table 1 summarizes the resultant four-dimensional measurement instrument.

Segars and Grover next turned their attention to large-scale data collection, sampling top computer executives nationwide. The survey was administered to 550 potential respondents, resulting in 253 usable returns. The data were subjected to a series of confirmatory analyses in order to establish convergent and discriminant validity. Assessment of their initial measurement model resulted in the deletion of four items from the scale: Items AL1 and AL2 from the alignment dimension, and Items AN2 and AN5 from the analysis dimension. The final first-order and second-order measurement model results are displayed in Figures 1 and 2, respectively, along with various goodness-of-fit statistics.

CRITIQUE OF SEGARS AND GROVER'S RESULTING MODEL

Segars and Grover offered final first- and second-order measurement models that fit the data reasonably well. For the first-order model, they obtained χ^2 (293) = 420.02 ($p<.0001$), goodness-of-fit index (GFI) of .89, and adjusted goodness of fit index (AGFI) of .87. For the second-order model, fit indices were: χ^2 (295) = 421.79 ($p<.0001$), GFI = .89, and AGFI = .87. With a target coefficient of T=.99 (Marsh and Hocevar 1985), one can conclude that the more restrictive second-order model is more than sufficient to explain the relations within the first-order model. On the negative side, however, the statistically significant χ^2 values suggest that the models still differ significantly from the data. Of course the sensitivity of the χ^2 statistic to sample size is well established (see, for example: Bentler and Chou 1987; Marsh et al. 1988). Segars and Grover offer the normed χ^2 (original χ^2 divided by degrees of freedom) as a commonly used standard against which to judge model adequacy. With a normed χ^2 = 1.43, they conclude that the model provides good fit.

Unfortunately, several objections can be raised to the final models offered by Segars and Grover. First, a model that does not significantly differ from the data is still the preferred outcome of fitting covariance structure models. Minor misspecifications can indeed produce models that differ significantly from the data. Bentler and Chou (1987) have provided a number of guidelines to assist researchers in the practicalities of using covariance structure models. They therefore recommend that when theory is not yet well developed, researchers are advised to hold the number of variables analyzed to under 20. Segars and Grover retain 26 variables in their final model, creating ample opportunity for specification errors.

A second limitation of Segars and Grover's model concerns the relatively small sample size. Although their sample size (n=253) appears on its face to be reasonable, one must also consider the ratio of sample size to the number of free parameters being estimated. Bentler and Chou (1987) again offer a strong recommendation in this respect: the ratio of sample size to free parameters should preferably be 10:1, and under the best conditions (all assumptions carefully met) should be *no less than 5:1*. The Segars and Grover ratio falls short of what is *minimally* required *under the best of circumstances*: 4.36:1 and 4.51:1 for their first- and second-order models, respectively.

Finally, indicators of constructs should not measure more than a single construct, a property known as unidimensionality. The preference for multiple, "pure" measures of constructs has been noted by Anderson and Gerbing (1988) as well as by Segars (1997). Such measures, termed *congeneric* by Jöreskog (1971), provide the clearest interpretation of constructs. Models containing congeneric measures can be contrasted to those in which measured indicators may have correlated errors or may load on more than a single construct. Measured variables must be carefully scrutinized on substantive grounds to guarantee that they reflect *only* the construct of interest. Unfortunately, the validation procedures performed by Segars and Grover strongly favor the inclusion of constructs over their exclusion. Although many of the retained measurement items loaded significantly on the underlying latent constructs, they were not critically examined for the possibility of measuring ancillary or secondary concepts.

Measures that confound concepts can seriously mislead researchers. The mere naming of constructs tends to reify their measurement purity, a purity that may not be justified by the composition of indicators. For years, psychologists studying the nature of mood and emotion have argued whether positive and negative affect reflect a single bipolar dimension or distinct dimensions. Arguments have raged over the role of random measurement error in attenuating correlations, the ability of systematic error (method bias, for example) to actually reverse the sign of correlations, and the problem of confounded measures in creating superfluous dimensions. (See, for example: Diener and Emmons 1985; Green et al. 1993; Russell 1979; Watson et al. 1988.) Quite recently, Barrett and Russell (1998) demonstrated how measurement error, combined with confounded and mislabeled constructs, can lead to serious misinterpretations. After carefully controlling and balancing positive/negative adjectives and properly modeling a second related dimension (activation–deactivation), they found a clear bipolar valence dimension (pleasant–unpleasant) for affect. They also demonstrated that the biased selection of activation-based adjectives (over deactivation adjectives) to represent items for separate positive and negative dimensions actually resulted in changing the angle between positive and negative dimensions from 180 degrees (bipolar) to something less than 180 degrees (for example, 115 degrees). To the researcher who takes as given that the positive and negative measures are pure, the results appear to confirm the independence of positive and negative affect. This work by Barrett and Russell (1998) on affect bipolarity clearly demonstrates how important unidimensionality of constructs can be in the proper interpretation of relationships.

In a recent commentary, Chin (1998) further highlighted critical issues in constructing measurement models. In particular, he made the important distinction between *reflective* and *formative* indicators of latent constructs. Reflective indicators reflect the latent construct and can be expected to change collectively when the underlying construct changes in value. Formative indicators, because they impact independently on the latent construct, may vary independently of one another. Chin provides the following example:

> "[One] example of formative measures would be the amount of beer, wine, and hard liquor consumed as indicators of mental inebriation. Potential reflective measures might be blood alcohol level, driving ability, MRI brain scan, and performance on mental calculations. If truly reflective, an improvement in the blood alcohol level measure for an individual would also imply an improvement in the MRI activity and other measures since they are all meant to tap into the same concept or phenomenon. Conversely, for the formative measures, an increase in beer consumption does not imply similar increases in wine or hard liquor consumption." [p. ix]

In constructing measurement models of latent constructs, structural equation modeling methods assume that indicators of latent variables are reflective.

A REVISED MEASUREMENT MODEL OF SISP SUCCESS

The preceding discussion highlights a general need to simplify the model of Segars and Grover before assessing fit. First, since the theoretical foundation for developing this particular SISP success instrument is still young, Bentler and Chou's admonition to keep the number of variables analyzed to less than 20 is well noted. Second, the sample size of 253 dictates reducing the number of measured variables to a number that will render a sample-size-to-free-parameters ratio of closer to 10:1. Third, in identifying items to drop from the measurement model, care should be taken to re-examine the theoretical definitions of all constructs for purposes of (1) deleting any items that may theoretically measure more than the single construct each is intended to measure, and (2) retaining the clearest exemplars of the underlying theoretical construct descriptions. Finally, to facilitate model identification, the selection task was approached with a mind toward identifying at least three indicators for each of the four dimensions specified by Segars and Grover. In the event that exactly three indicators were identified for each latent construct, the resulting measurement model would involve 16 indicators and 4 latent variables, with a sample size to estimated parameters ratio of between 8:1 and 9:1.

With the *final* model of Segars and Grover as a starting point, all items were reviewed in light of the constructs they should theoretically measure. The items eventually retained for each construct are noted in bold in Table 1. In the case of alignment, retention of items focused on those which captured the extent to which the CIO (Chief Information Officer) proactively addressed alignment of IT with the strategic goals of the firm. Excluded were items that did not reflect *direct efforts* of alignment, as well as items that conceptually overlapped other constructs to be measured. Item AL5 (Identifying IT-related opportunities to support the strategic direction of the firm) seemed to be a necessary and enabling condition to allow other actions captured by Items AL3, AL4, and AL5. Item AL6 seemed to capture an *indirect* method of influencing strategic policy at the firm level rather than direct alignment activity. Item AL8 also reflected an enabling condition for alignment. Moreover, assessment of the strategic importance of emerging technologies came too close to cross-capturing the analysis construct (beyond just alignment) and was therefore dropped. The three items retained were AL3 (Adapting the goals/objectives of IS to changing goals/objectives of the organization), AL4 (Maintaining a mutual understanding with top management of the strategic role of IS), and AL7 (Adapting technology to strategic change.

Turning next to the analysis construct, Item AN1 (Understanding the information needs of organizational subunits) was immediately rejected as being unduly vague. Furthermore, experience with curriculum assessment inventories suggests that items involving generalized notions of “Understanding . .

." nearly always provide little discriminative power. [For example, in their classic text on instructional design, Gagné et al. (1992) warn against using such verbs as "understand" in writing educational objectives and assessments, even though "understanding" may reflect the general goal of instruction.] AN3 also contained the same vague notion of "understanding the organization" and was therefore rejected. Additionally, both fail to capture the essence of specific *analysis* activity and merely reflect enabling conditions that must obviously hold for proactive analysis efforts. AN4 (Development of a blueprint . . .) and AN7 (Generating new ideas . . .) were retained since they reflect proactive analytical efforts. In trying to retain three items per construct, it was necessary to choose between items AN6 (Maintaining an understanding of changing organizational processes and procedures) and AN8 (Understanding the dispersion of data, applications, and other technologies throughout the firm), both of which again spoke to vague issues of understanding instead of more detailed analytical issues. Because knowledge of the workings of individual units and their processes should probably be captured in some way and was addressed in two other items previously eliminated (AN1 and AN3), item AN6 was selected for retention based on its more general wording (though the decision was somewhat arbitrary).

Three items most faithfully captured the concept of cooperation and did so in clear and distinct ways: CO4 (Maintaining open lines of communication with other departments), CO5 (Coordinating the development efforts of various organizational subunits), and CO6 (Identifying and resolving potential sources of resistance to IS plans). Other items did not *directly* involve cooperation, instead suggesting that project structuring activities might constitute an additional separate construct that may moderate cooperation. Therefore, the following items were dropped: CO1 (Avoiding system overlap), CO2 (Agreement regarding system risks/tradeoffs), CO3 (Uniform criteria for project prioritization), and

CO7 (Existence of clear managerial responsibility for implementation). The deleted items dealt more with project management structuring than directly constituting cooperative activities.

Finally, in turning to improvement in capabilities, several items were eliminated due to their apparent overlap with other constructs. Item CA1 (Ability to identify key problem areas) probably reflects analytical ability in addition to capacity for *improvement*. Item CA2 (Ability to identify new business opportunities) appears to vaguely relate to identification of strategic opportunities and hence alignment. Item CA3 (Ability to align IS strategy with organizational strategy) quite directly refers to the alignment function of the first construct. Finally, CA7 (Ability to gain cooperation among user groups for IS plans) overlaps with the cooperation construct. The important thing to note regarding the current construct is that it theoretically stresses *improvement in capability* rather than simple capability. The remaining three items each directly address adaptivity. CA4 asks about anticipation of surprises and crises, CA5 (though somewhat vague) addresses organizational information needs, and CA6 suggests the importance of flexibility in adapting to change.

The deletions/retentions that made here may appear arbitrary to some, and indeed they may be little more than empty rationalizations. However, one must remember the guideline that covariance structure methods are confirmatory and decisions of model specification are best made on the basis of substantive concerns. More importantly, modifications offered in the present analysis were decided *a priori*. Furthermore, the critical statistical issues raised earlier relating to sample-size, free-parameter ratio, and model complexity have simultaneously been addressed through model simplification. It is possible that random retention of three indicators per construct might produce an equally good-fitting solution, and this issue will be taken up in more detail in the discussion.

Next, the fit of the simplified first- and second-order models was examined using Segars and Grover's original data set. The resultant parameter estimates and goodness-of-fit indices are shown in Figures 3 and 4. As can be seen in Figure 3, the simplified first-order measurement model provides a vastly superior fit. Not only is the obtained χ^2 not statistically significant [χ^2 (48) = 54.25; p = .24] (indicating no significant difference between the model and the data), but the goodness-of-fit and adjusted-goodness-of-fit indices indicate a much better fit than that obtained by Segars and Grover (GFI of .97 compared to .89; AGFI of .94 compared to .87). Additionally, all coefficients for each item's loading on its relevant construct were statistically significant at the .05 level. Comparable statistical information on individual parameter estimates was not provided by Segars and Grover, so only cursory comparison of obtained coefficients is possible. Also important to note is the fact that neither the Wald test nor the Lagrange Multiplier (LM) test suggested any modifications in the first-order model.

Analysis of the revised second-order measurement model produced results similar to those for the first-order model (see Figure 4). Again the model did not provide a fit significantly different from the data [χ^2 (50) = 55.83; p = .26]. The goodness-of-fit index for the revised second-order model was .97 (compared to .89), and adjusted goodness-of-fit index was .95 (compared to .87). Individual factor loadings were also good, with all coefficients for the alignment, cooperation, and capability construct significant at the .05 level. Coefficients for the analysis construct were all significant at the .10 level. Loadings on the higher-order SISP success construct for alignment, cooperation, and capability were significant at the .05 level, while the alignment construct loading was significant at the .10 level. The target coefficient (Marsh and Hocevar 1985) obtained for the revised first- and second-order models was identical to that obtained by Segars and Grover (T = .99). Table 2 summarizes some additional fit indices, all of which show excellent fit for both the first- and second-order models.

CONCLUSIONS

The revised measurement model offered here addresses several key concerns raised in the previous discussion of Segars and Grover's results. First, given the preliminary theoretical framework guiding instrument development, analysis of a simplified model is in order. Second, the ratio of sample size to freely estimated parameters in the simplified model more closely conforms with practical guidelines for fitting covariance structure models: 8.43:1 compared to 4.36:1 for the first-order model, and 9.04:1 compared to 4.51:1 for the second-order model. Third, several items clearly overlap concepts and do not reflect the pure unidimensionality that is preferred in multiple-indicator measures of constructs. Those items have been removed from the revised model in the interest of retaining only the most pure indicators. Finally, the items retained for each latent construct more closely resemble the *reflective* measures assumed by structural equation modeling methods (Chin, 1998). While specification of *formative* (or causal) indicators requires inclusion of all aspects contributing to a given construct, measures of the underlying latent construct need only *reflect* the construct. Thus, large and overly inclusive sets of items are unnecessary. The simplified model presented in the present article more faithfully represents this assumption of the reflective relationship between latent constructs and measures.

Of greatest importance, the simplified measurement model provides superior vastly superior fit. First, the revised measurement model did not differ significantly from the observed data. Second, the various goodness-of-fit and adjusted goodness-of-fit indices showed much better fit than that obtained by Segars and Grover (GFI of .97 compared to .89; AGFI of .94 compared to .87). Finally, all item loadings proved to be statistically significant at the .05 level. The result is a much crisper measurement model of SISP success.

The revisions presented here bear two key limitations. First, we collected no new data to be used as the basis for testing the simplified measurement model. The reduced set of items awaits secondary validation and replication in the context of future research. A second, more troubling issue is the extent to which the improved fit obtained here is little more than an artifact of using a simple model. Clearly, complex models offer greater opportunity for specification error. However, in reducing the number of indicators, the choices made here have been argued on both substantive and measurement grounds. To look at the possibility that the items *excluded* in the revised model may fit the data equally well, a measurement model of equal complexity was constructed. Recall that items eliminated from the original measurement instrument included three alignment items, three analysis items, and four items each from the cooperation and capability subscales. To construct a model of equivalent complexity, one item was randomly discarded from the set of deleted items for each of the cooperation and capability latent variables. The resultant "test" model comprised three items for each of the latent factors: alignment (AL5, AL6, and AL8), analysis (AN1, AN3, and AN8), cooperation (CO1, CO2, and CO7), and capability (CA1, CA2, and CA7). Tables 3a and 3b display some of the output from the EQS statistical package. Analysis of the goodness-of-fit for the first-order model (Table 3a) revealed an excellent fit, much improved over the final model of Segars and Grover. However, some misspecification appears to be evident from the output of the Lagrange Multiplier (LM) test (Table 3b). Consistent with earlier arguments made regarding cross-construct contamination of some measured indicators, the LM test suggests that V8 (Item CO2) should be allowed to load on the alignment factor (F1) in addition to the cooperation factor (F3). Similarly, the LM test suggests freeing the parameter between V2 (AL6) to load on the cooperation factor (F3) as well as alignment (F1). Of course, the "leftover" items used to construct the current test model probably define somewhat different underlying constructs and should not necessarily be taken as reflecting the original labels. Thus freeing the parameters suggested by the LM test may not make substantive sense.

The quick analysis of the test model offered above does point to the significant role that mere simplification played in improving the fit of the measurement model. However, items designed to measure latent variables *should make sense* in the context of the theoretical definitions provided. Future simulations (Monte Carlo or bootstrapping) should address the precise impact of model complexity in light of varying sample sizes, random and systematic errors, and unbalanced numbers of indicators across latent constructs. The simplified model presented here also requires replication and validation with an independent sample. Should a particularly large sample be available, one could test the complete set of items included on Segars and Grover's final measurement model.

The model modifications suggested here should in no way detract from the major contribution made by Segars and Grover in the development of a valid and reliable instrument to measure strategic information systems planning success. The present analysis instead has attempted to shed light on some long-forgotten admonitions and guidelines, particularly with respect to scale unidimensionality, the reflective versus formative measures, model complexity, and requisite sample sizes for assessing complex models. Furthermore, researchers may find the shortened instrument proposed here particularly useful in their research efforts. The quotation by Macklin provided at the beginning of this article expresses the importance of a good foundation. Just as "Every tub must stand upon its feet," so too should tests of structural relationships rest upon valid and reliable measures.

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Table 1.

Segars and Grover (1998) — Initial Item Set

Note: All items measured on a seven-point scale anchored by "entirely unfulfilled" and "entirely fulfilled." Items marked with an asterisk (*) were later dropped due to lack of reliability. Items in bold denote those retained in the model proposed in the present paper.

Alignment

*AL1. Understanding the strategic priorities of top management.
*AL2. Aligning IS strategies with the strategic plan of the organization.
AL3. Adapting the goals/objectives of IS to changing goals/objectives of the organization.
AL4. Maintaining a mutual understanding with top management on the role of IS in supporting strategy.
AL5. Identifying IT-related opportunities to support the strategic direction of the firm.
AL6. Educating top management on the importance of IT.
AL7. Adapting technology to strategic change.
AL8. Assessing the strategic importance of emerging technologies.

Analysis

AN1. Understanding the information needs of organizational subunits.
*AN2. Identifying opportunities for internal improvement in business processes through IT.
AN3. Improved understanding of how the organization actually operates.
AN4. Development of a "blueprint" which structures organizational processes.
*AN5. Monitoring of internal business needs and the capability of IS to meet those needs.
AN6. Maintaining an understanding of changing organizational processes and procedures.
AN7. Generating new ideas to reengineer business processes through IT.
AN8. Understanding the dispersion of data, applications, and other technologies throughout the firm.

Cooperation

CO1. Avoiding the overlapping development of major systems.
CO2. Achieve a general level of agreement regarding the risks/tradeoffs among system projects.
CO3. Establish a uniform basis for prioritizing projects.
CO4. Maintaining open lines of communication with other departments.
CO5. Coordinating the development efforts of various organizational subunits.
CO6. Identifying and resolving potential sources of resistance to IS plans.
CO7. Developing clear guidelines of managerial responsibility for plan implementation.

Capability

CA1. Ability to identify key problem areas.
CA2. Ability to identify new business opportunities.
CA3. Ability to align IS strategy with organizational strategy.
CA4. Ability to anticipate surprises and crises.
CA5. Ability to understand the business and its information needs.
CA6. Flexibility to adapt to unanticipated changes.
CA7. Ability to gain cooperation among user groups for IS plans.

Table 2.

Goodness of Fit for Revised Measurement Models

Fit Index	**1st Order (df = 48)**	**2nd Order (df = 50)**
χ^2	54.250	55.834
χ^2 normed	1.136	1.117
NFI	0.970	0.970
NNFI	0.995	0.996
CFI	0.996	0.997
IFI	0.996	0.997
GFI	0.966	0.965
AGFI	0.944	0.945
SRMS	0.023	0.025

Table 3a.

Output from Simplified Model Using Deleted Items
(Goodness of Fit)

```
GOODNESS OF FIT SUMMARY

INDEPENDENCE MODEL CHI-SQUARE =   1507.365 ON   66 DEGREES OF FREEDOM

INDEPENDENCE AIC =  1375.36507   INDEPENDENCE CAIC =  1076.16137
MODEL AIC =   -30.69365          MODEL CAIC =  -248.29635

CHI-SQUARE =       65.306 BASED ON    48 DEGREES OF FREEDOM
PROBABILITY VALUE FOR THE CHI-SQUARE STATISTIC IS     0.04885
THE NORMAL THEORY RLS CHI-SQUARE FOR THIS ML SOLUTION IS     61.413.

BENTLER-BONETT NORMED    FIT INDEX=       0.957
BENTLER-BONETT NONNORMED FIT INDEX=       0.983
COMPARATIVE FIT INDEX (CFI)      =       0.988
BOLLEN (IFI)             FIT INDEX=       0.988
McDonald (MFI)           FIT INDEX=       0.966
LISREL GFI               FIT INDEX=       0.961
LISREL AGFI              FIT INDEX=       0.937
ROOT MEAN SQUARED RESIDUAL (RMR)  =       0.030
STANDARDIZED RMR                  =       0.029
```

Table 3b.

Output from Simplified Model Using Deleted Items
(Lagrange Multiplier Test)

```
MULTIVARIATE LAGRANGE MULTIPLIER TEST BY SIMULTANEOUS PROCESS IN STAGE  1

  PARAMETER SETS (SUBMATRICES) ACTIVE AT THIS STAGE ARE:

     PVV PFV PFF PDD GVV GVF GFV GFF BVF BFF


         CUMULATIVE MULTIVARIATE STATISTICS             UNIVARIATE INCREMENT
         ----------------------------------             --------------------
  STEP  PARAMETER   CHI-SQUARE  D.F.  PROBABILITY       CHI-SQUARE  PROBABILITY
  ---- -----------  ----------  ----  -----------       ----------  -----------

    1     V8,F1        4.347      1      0.037             4.347       0.037
    2     V2,F3        8.586      2      0.014             4.239       0.040
```

Note: F1 = Alignment factor; F2 = Cooperation factor; V8 = CO2- Achieve a general level of agreement regarding the risks/tradeoffs among system projects; and V2 = AL6- Educating top management on the importance of IT.

Figure 1.
Segars and Grover (1998) Final First-Order Measurement Model

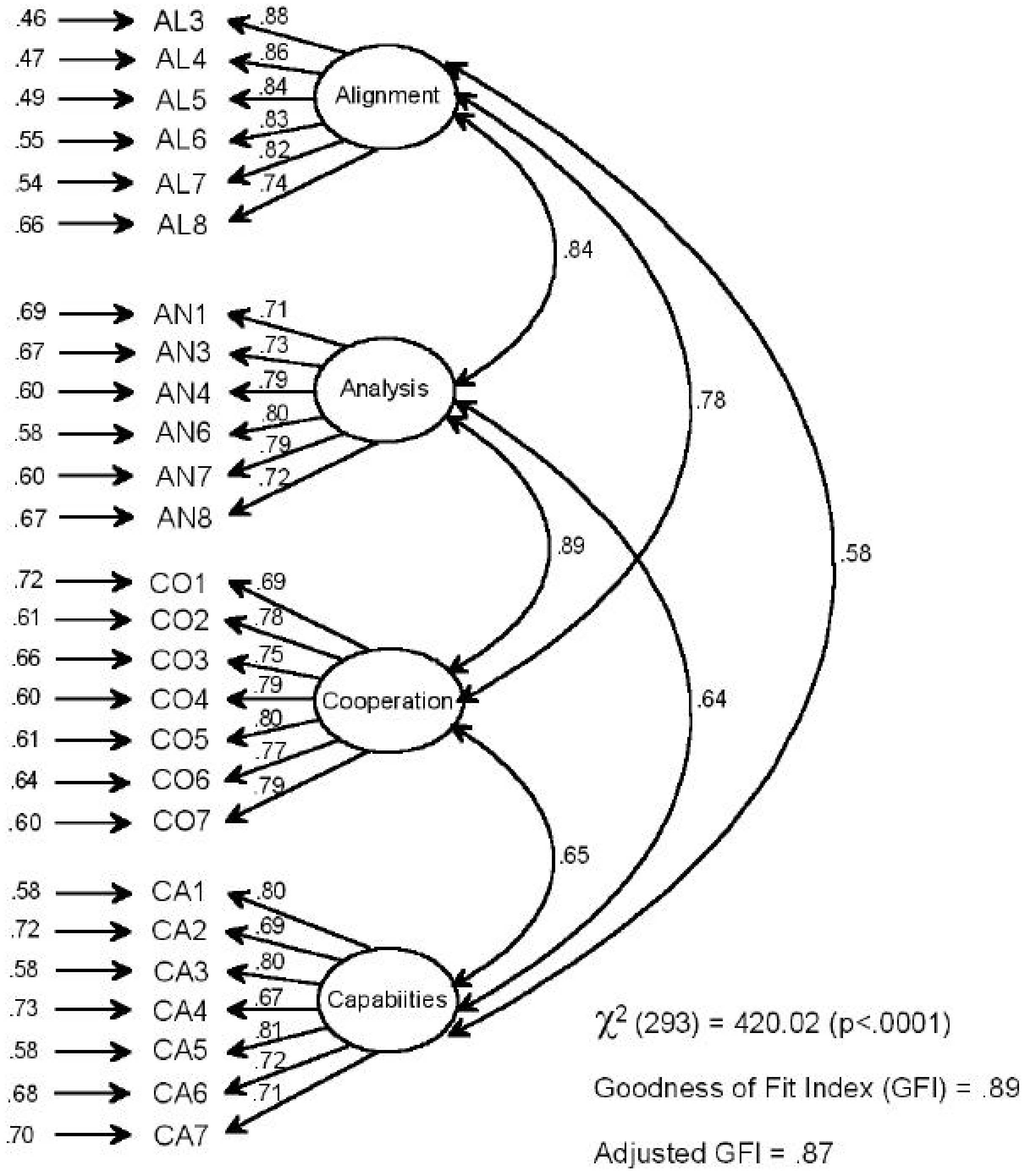


Figure 2.

Segars and Grover (1998) Final Second-Order Measurement Model

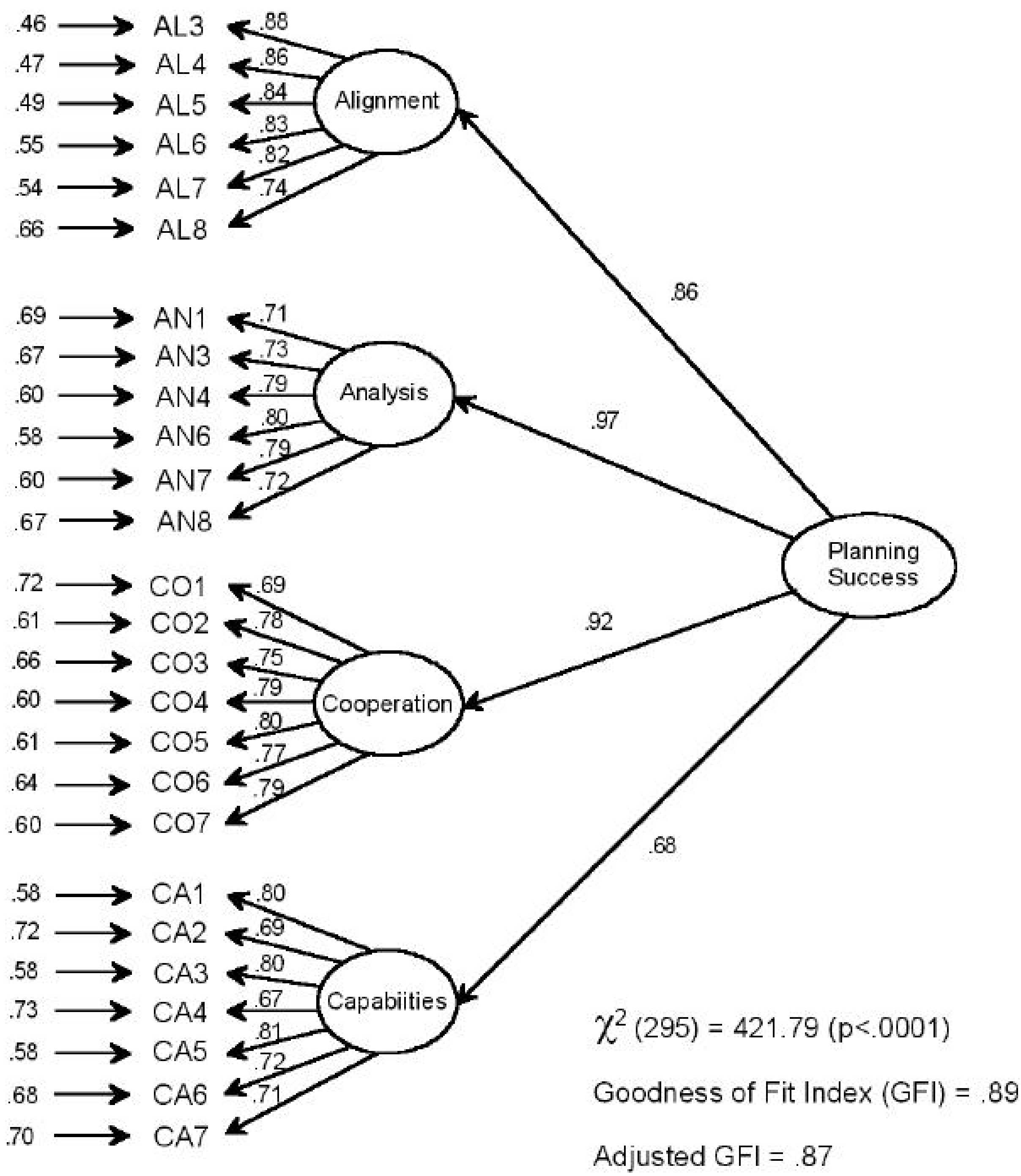


Figure 3.
Revised First-Order Measurement Model of SISP Success

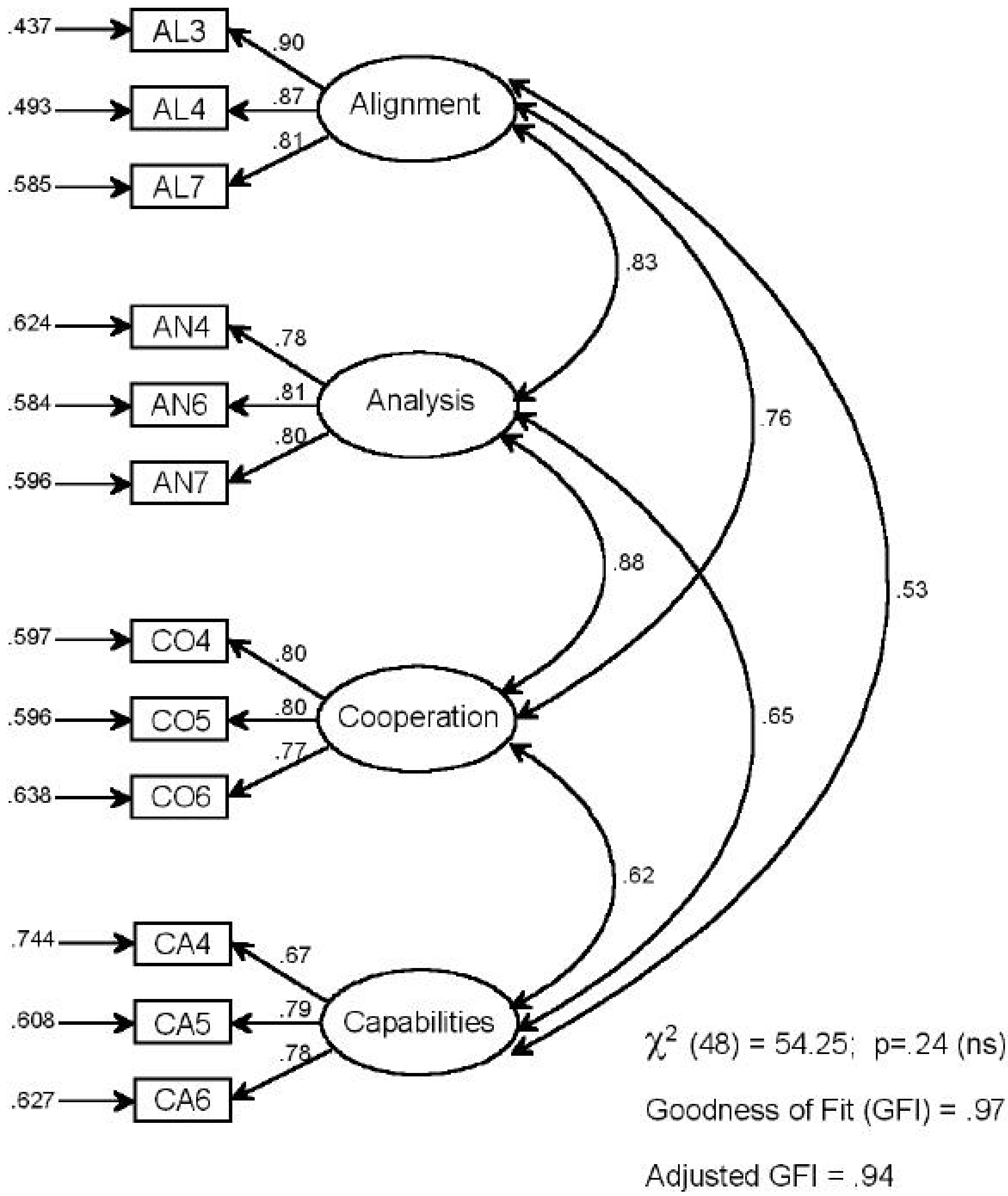
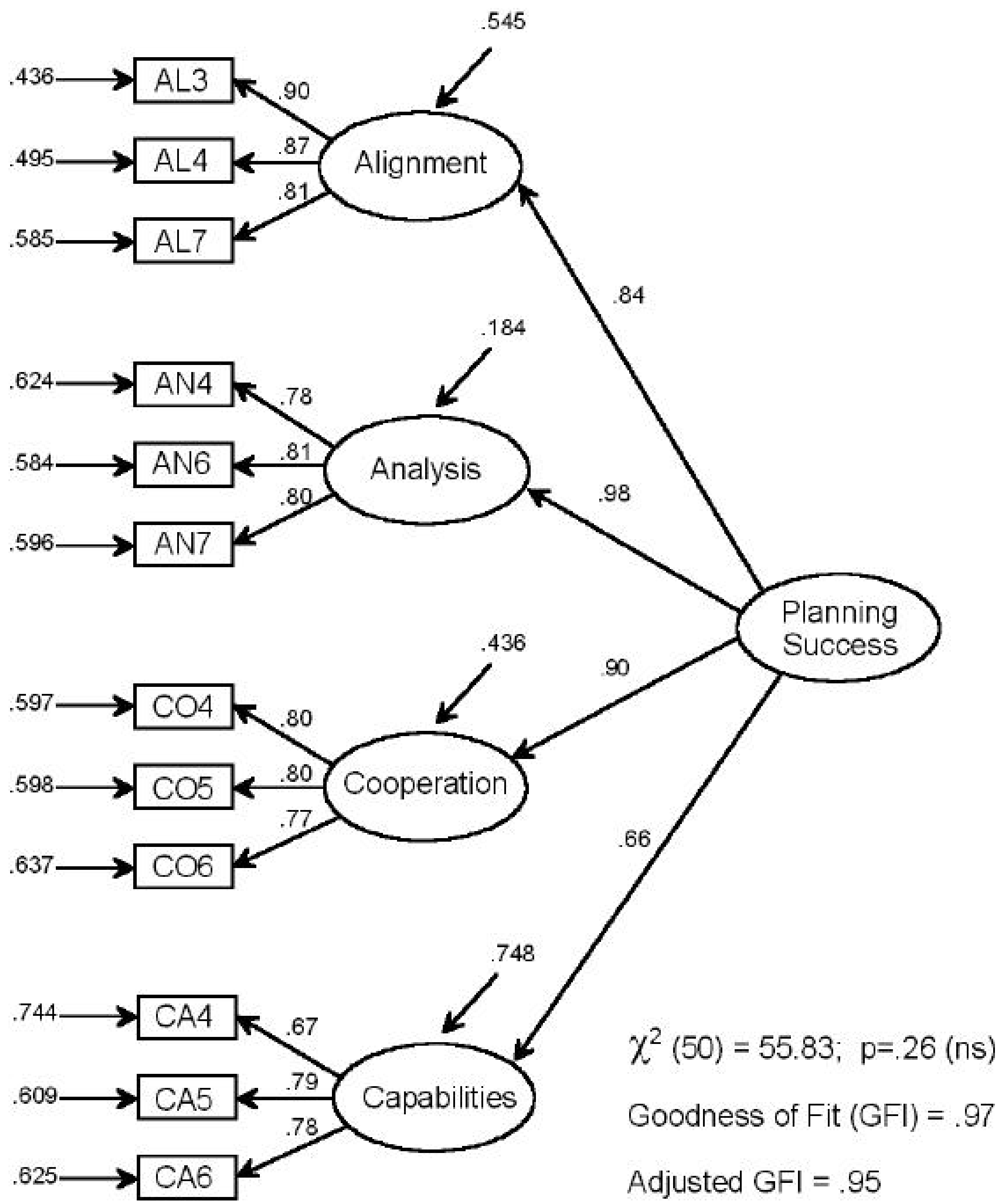


Figure 4.

Revised Second-Order Measurement Model of SISP Success



APPENDIX

— Shortened SISP Measurement Instrument —

Alignment

AL3. Adapting the goals/objectives of IS to changing goals/objectives of the organization.

AL4. Maintaining a mutual understanding with top management on the role of IS in supporting strategy.

AL7. Adapting technology to strategic change.

Analysis

AN4. Development of a "blueprint" which structures organizational processes.

AN6. Maintaining an understanding of changing organizational processes and procedures.

AN7. Generating new ideas to reengineer business processes through IT.

Cooperation

CO4. Maintaining open lines of communication with other departments.

CO5. Coordinating the development efforts of various organizational subunits.

CO6. Identifying and resolving potential sources of resistance to IS plans.

Capability

CA4. Ability to anticipate surprises and crises.

CA5. Ability to understand the business and its information needs.

CA6. Flexibility to adapt to unanticipated changes.