Towards Decision Aids

in

Internal Control Evaluation

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Abstract

In this experimental study, auditors were asked to estimate the reliability of a hypothetical internal control system. Both the accuracy of the auditors' decisions and the form of their decision-making were compared with the output and structure of a model based on reliability theory. The results indicate that auditor decisions differ widely from the optimal model, being poorly calibrated with it, biased and oversensitive relative to it, and exhibit a linear structure where the model is nonlinear. A case is made for the explicit incorporation of reliability-theory-based decision aids in the audit process.

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1. Introduction

The evaluation of internal control systems is an important concern of auditors, a crucial part of the evidence collection and inference work done in the course of an audit. The AICPA's[1] second standard of field work mandates evaluation of the internal control system as a basis for restricting substantive tests. Furthermore, SAS No. 20 (AICPA, 1980) requires communication of internal control weaknesses to management.

A number of audit researchers have attempted to describe aspects of auditor decision processes in the evaluation of internal control. For example, Ashton(1974, 1982) used consensus and stability measures to describe how auditors evaluate internal control reliability. This trend of research was continued by Joyce (1976) and Gaunmitz et. al. (1982). Others have attempted to represent the underlying error logic of auditors with models borrowed from other disciplines in order to prescribe how auditors should rate the reliability of internal controls. For example, Cushing (1974, 1975) adapted concepts from the field of reliability engineering to represent the internal control system as a network of interrelated components with each component representing one internal control procedure. Bodnar (1975), Stratton (1981) and Srivastava (1983) have further refined the model developed by Cushing. Yu and Neter (1973) modeled the error in accounting data as a stochastic variable and used probability transformation for each system

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1. See AU150.02 - Standards of Field Work - AICPA.

element to trace the probability of error through the system.

This study provides a bridge between the descriptive and model-building studies. In the following analysis, the internal control evaluation decision is dissected into a sequence of three simple and separable decision stages: the estimation stage, the aggregation stage, and the interpretation stage. Existing probability and reliability models are used to identify known relationships between input and output variables at each stage. Knowledge of these relationships can simplify the auditor decision process by obviating the need for some investigation. For example, an auditor need not "decide" on the probability of occurrence of an error if it is known that the error is caused by any of two independent procedures whose error probabilities are known. He could use the standard result from reliability theory to estimate the ultimate probability. However, the auditor must decide if the two procedures are independent and if the error is caused by either or both the procedures being incorrect.

The purpose of this study is to model such reliability-theory-based decision approach and to empirically examine the relationship of such approaches to the actual practice of auditors in judging the reliability of internal control systems. When presented with internal-control scenario that is optimally analyzed using reliability theory, how do auditor judgments measure up? Do auditors in fact use models similar to those prescribed by reliability theory? This study provides results relevant to those two questions, with particular attention to one stage of the internal control evaluation process, the aggregation stage.

2. Analysis of Decision Stages

2.1 An Overview of Reliability Theory

This study uses a standard reliability model with serial and parallel components.[2] In order to facilitate further discussion, basic definitions and terminology are introduced briefly in this section.

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2. In adapting the reliability model to the internal control system context, the activities and controls in the system will be considered as components. For example, in a purchasing system, purchase ordering, receiving and vouchering are activities which are considered as serial components. Reviewing a purchase order (PO), comparing the PO with a receiving report (RR), etc. are controls which are considered as components in parallel with the activities they control. This adaptation, developed by Stratton (1981) is explained in the latter part of this section.

From a reliability standpoint the accounting system of a firm may be viewed as a network of interacting components. These components can either be activities (such as purchase-order preparation) or control procedures (such as the comparison of the vendors' invoice, purchase order and receiving report). The output of the firm's accounting system is a set of financial statement numbers which can be either correct (i.e., free of accounting errors) or incorrect.

Let x_i indicate the state of component i in the system. $x_i=1$ if the component i is "successful" and $x_i=0$ otherwise. In an accounting context an activity is successful if accurate within materiality limits. A control procedure is successful if its application results in the detection and correction of any error in an activity. The state of the accounting system is represented by a binary variable ϕ which takes the value of 1 if the financial statement number(s) produced by the system are error-free and 0 otherwise. Reliability theory postulates that ϕ is a function of x_i's. i.e., $\phi=\phi(x_1,x_2,...x_n)$ where n is the number of components in the system. The function $\phi(x_1,x_2,...x_n)$ is called the STRUCTURE FUNCTION.

Component reliability (p_i) is defined as the probability of success of component i and can be easily seen to be the expected value of x_i. [i.e., $p_i=E(x_i)$.] System Reliability (h) is defined as the probability of success of the system (i.e., the probability that the output of the system is error-free) and can be expressed as a function of component reliabilities, i.e., $h=h(p_1,p_2 \cdots p_n)$. [The Reliability Function.]

The following relationships are presented here for the sake of completeness:

$h(p_1,p_2 \cdots p_n)=E[\phi(x_1 \cdots x_n)]$ where E is the expectation operator

If components are independent,[3]

$$h(p_1,p_2 \cdots p_n) = E[\phi(x_1 \cdots x_n)] = \phi[E(x_1),E(x_2), \cdots E(x_n)] = \phi[p_1,p_2...p_n]$$

i.e., the reliability function has the same functional form as the structure function.

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3. Two components (i,j) are said to be independent if $P(x_i|x_j=0)=P(x_i|x_j=1)$ and $P(x_j|x_i=0)=P(x_j|x_i=1)$, where P denotes the probability.

Two reliability functions are of particular interest. If two (or more) components are such that an error in any of the components is sufficient for an error in the system, the components are said to be serially connected. The reliability function is simply the product of p_i's, i.e., of the form $h=p_1{}^*p_2{}^*p_3{}^* \cdots p_n$. If two (or more) independent components are such that an error in every one of the components is necessary for an error in the system, the components are said to be connected in parallel. The reliability function is of the form $h=1-(1-p_1)(1-p_2)(1-p_3) \cdots (1-p_n)$.

An important result in reliability theory is that *any system* can be represented in terms of combinations of serial and parallel connections of components.

In an accounting system, certain activities need to be successful for the system output to be correct. For example, the purchase ordering activity, material receipt activity and voucher preparation must all be correctly carried out for the final posting (of inventory and accounts payable ledgers) to be correct. These activities, then, can be considered as serial components of the system which produces the final accounting entry. Now, consider each activity per se. The activity can have certain control procedures associated with it. The output from the activity will be incorrect only if the activity was incorrectly performed in the first place and if all the controls for that activity failed to rectify the error. The controls can then be considered as components which are connected in parallel with the activity. If the activities and controls are judged to be independent, the reliability function represents a normatively "correct" rule to aggregate the reliabilities to a system reliability measure.

2.2 The Decision Stages

Srinidhi & Vasarhelyi (1986) discussed the usage of reliability theory for evaluating internal controls and identified pertinent stages. The stages of decision making in internal control evaluation identified by them are shown in Figure 1. A brief review of these stages is given here for the sake of completeness.

Insert Figure 1 here

In the estimation stage, prior expectations of component reliabilities are estimated based on the probabilities of unintentional and intentional errors. The probability of unintentional error is influenced by organizational and environmental factors such as the segregation of duties, the competence and

awareness of the personnel and the complexity of the task. For example, if the task is complex, the probability of unintentional error in the performance of the task is high. Consequently, the prior expectation of the reliability of the component is low. The probability of intentional error is influenced by such factors as the integrity of the personnel, the benefits which accrue to the perpetrator of the error if the error goes undetected and the costs imposed on him/her if the error is detected and inferred as intentional. For example, if the extent of monitoring (internal audit, supervision of the task etc.) is high, the probability of error detection is high and probably the cost imposed on the employee who commits the error is also high. In such a case, the probability of intentional error decreases and the prior expectation of component reliability is high. The prior expectations are then updated using the results of compliance tests.

In the aggregation stage, which is the focus of this paper, the auditor identifies the structure function by analyzing the flow of errors in the system. For example, activities such as purchase-order (PO) preparation, receiving report (RR) preparation and voucher entry are in series because an error in any one of them results in a wrong entry. On the other hand, any control such as a review of purchase order accuracy would be in parallel with the purchase order preparation activity. A control which compares PO and RR and corrects errors in either would be in parallel with both the PO preparation and the RR preparation activities. Once the positioning of each activity and control in the system is determined, the auditor can derive one structure function ϕ of the system using standard reliability theory. If the components are independent the structure function can be used to aggregate the estimated component reliabilities into a system reliability number.

These system reliability numbers are complements of the error probabilities in transactions. Ultimately, the auditor is interested in estimating the probability distribution (pdf) of errors in account balances, which he or she then considers in conjunction with the additional factors of tolerable audit risk and materiality to plan the optimal extent and timing of substantive tests.

3. Empirical Validation

3.1 Issues for Empirical Research

The preceding two subsections modeled the potential usefulness of reliability theory in the aggregation stage of internal control evaluation. What remains empirically is to determine if auditors need to explicitly incorporate such reliability models into their decision making.

When the component activities and controls in an internal control system are independent, we know that reliability theory gives the correct aggregation procedure. In this study, we present such a scenario to auditors, and then compare their judgments with the outcomes from the model. Material differences between the two would serve as an indication that reliability theory has the potential to be a useful decision aid for auditors.

One way of comparing the auditor and model is to find the degree of calibration [4] of auditor judgments with model outcomes. A second approach seeks to yield insights into the decision process vis a vis the model. Thus the study investigates two related research questions, one pertaining to decision outcomes, the other to the form of decision models.

The main research question then deals with calibration -- a comparison between the output of the decision process employed by the auditor and the output using reliability-theory.

The second research question deals with a comparison between the auditor's decision model and that prescribed by reliability theory. Reliability theory establishes a multiplicative model for serial activities and a complementary multiplicative model for parallel controls. Because of the compensatory nature of activity and control reliabilities, the model places a significant emphasis on interactions between components which cannot, in general be approximated by a linear model. By Contrast, studies by Hammond, Hursch and Todd (1964), Newton (1965), Slovic and Lichtenstein (1971, p.681), Goldberg (1968, p.488) have shown that a linear model is descriptive of human judges in most judgment

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4. Calibration refers to the closeness of auditor's response to the reliability computed using the model.

situations. Therefore, our prior expectation in exploring this second research question is that a linear. heuristic is descriptive of auditor judgments, but not of the model output. We also compare the sensitivities of auditor judgements with those of the model.

3.2 Research Methodology

3.2.1 Subject Characteristics[5]. The sample is homogeneous in age, education and training, and consists of 77 professional auditors drawn from a single "Big-Eight" audit firm. Most of the auditors were about 25 years of age with 2 to 3 years experience[6] in auditing. All of them had undergone the basic training up to the senior level. Almost all of them had accounting education either at the undergraduate or at the graduate level. A majority had experience in documenting and evaluating the internal control system in the purchase transaction cycle.

Since drawn from a single auditing firm, the sample restricts the generalizability of the study's findings. On the other hand this selection procedure allows for a much more homogeneous subject sample and a common understanding of the specific meaning of internal control evaluation ratings. Most firms have their own internal control evaluation procedures, but these vary substantially among firms (Cushing & Loebbecke, 1983). Choice of subjects from different firms would introduce substantial ambiguity into their task or require thorough retraining of subjects in the specific internal control representation used in the instrument.

3.2.2 The Experimental Task The experimental task required the subjects to evaluate the purchase transaction cycle of a hypothetical firm. The auditors taking part in the study were given a brief narrative describing the organization, along with a set of standard internal control documents laying out the basic structural aspects of the purchase transaction cycle.

After exposure to this information, the auditors were asked to make judgments concerning: (1) overall

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5. This is the same sample as was used in Srinidhi and Vasarhelyi (1986). However, the issues dealt with here are substantially different from those of the other paper.

6. Ashton (1974) indicates that an auditor requires two and one half to three years of experience until being allowed to make this type of judgment. (p.150)

system reliability, and (2) the ultimate level of substantive testing called for.[7]

The purchase system presented to the auditors consisted of three major activities: (1) purchase ordering, (2) receiving and (3) vouchering, and two major controls: (4) comparison of vendor invoice with PO and RR before approval and (5) comparison of the voucher with support documents. A reliability network representation of this five-component system is given in Figure 2.

Insert Figure 2 here

In the first section of the experiment, one of the five components was kept constant and the other four (factors) were varied at two levels of reliability (factor levels)[8]. This is a 2^4 factorial design. Auditors estimated the system reliability for each combination of such factor levels on a scale of 0 to 100 and specified the degree of substantive testing on a scale of zero to six (see Appendix). These judgements provided a basis for computing calibration and also constituted the dependent variables in a descriptive ANOVA technique used to the discover and describe factor usage in order to infer the form of auditors' decision models and their sensitivity to component reliabilities.

In the second section of the experiment, reliability numbers were simply provided to the auditors, who were then asked to specify one degree of substantive testing, again on a seven-point scale. The purpose of this second part is set out in section 3.2.4 below.

3.2.3 Experimental Consistency Every subject was given repeat questions for four of the sixteen systems examined. These questions were designed to evaluate subject experimental consistency. As the subjects did not notice these repetitions[9] a high correlation would indicate experimental consistency.

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7. In practice, the auditors first plan on the extent, timing and nature of substantive tests if no reliance is to be placed on the internal control system. Then, based on their evaluation of internal control system, they decide on how much reduction in the extent is justified and how far they can move the tests back from the year end (timing). In effect, the decision they take based on internal control evaluation is the degree of restriction of originally planned substantive tests. Therefore, in this paper, this decision is often referred to as substantive test restriction decision.

8. The factor levels are given in Table 3.

9. This was evaluated through the open-ended debriefing questionnaire.

Table 1 gives the test-retest correlations. The overall test-retest correlations for both the ratings and the error probability judgments are 0.759 and 0.649, respectively.

3.2.4 Method of Elicitation of System Reliability There is an extensive literature on direct and indirect elicitation of subjective probabilities, (Chesley, 1976). The two sections of the experiment, described above, permit an investigation of the robustness of the results to changes in elicitation method. The first section directly elicits the auditor's estimation of system reliability, and then asks for a level of substantive testing. The second section provides the reliabilities and again asks for a substantive-testing level. Each substantive-testing level is associated with both a given and an estimated reliability. Agreement between these two reliabilities would indicate a convergence of directly and indirectly elicited estimates, and in fact their mean correlation is 0.834, with a 95 percentile range of 0.71-0.986, indicating that the methods of elicitation are similar and interchangeable in this setting. Consequently, the directly elicited reliability estimates are employed in subsequent analysis.

4. Results

In this section, we present the results of the experiment concerning the two research questions. The section concludes with a summary of the findings.

4.1 Calibration

Calibration measures the conformity of auditor decisions with the estimates provided by the reliability model. The calibration of an auditor with the model was measured using both an associative and a bias measure.[10] The associative measure is based on the correlation of auditor-assessed reliabilities with model-assessed reliabilities. The bias measure is the normalized difference between those two reliabilities.

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10. Consider two sets of numbers (.2, 05, .08) and (.4, .10, .16). There two sets are "perfectly associated", i.e. the relation between 2 and 4 is the same as the relation between 5 and 10, and 8 and 16. Consider the first set to be the model-computed reliabilities of 3 situations and the second set to be the auditor judgments. The correlation between the two is 1 but, the auditor's judgments are systematically different. This difference is captured by a distance measure.

Table 2 gives the calibration-association and calibration-bias measures. The mean calibration association level is 0.549, with a range from 0.233 to 0.878, with a standard deviation of 0.154. The normalized calibration bias measure has a mean of 0.4079, which indicates significant underestimation. In fact, 25 of the 77 auditors consistently underestimated *all* reliabilities and no auditor consistently overestimated all reliabilities. The probability of this last outcome under a null hypothesis of random approaches zero, indicating that auditors are in fact poorly (though positively) calibrated with the model, and that they significantly underestimate system reliability.

Insert Table 2 here

4.2 Comparison of Auditor Decision Model with the Reliability Model

4.2.1 Analysis of Variance Table 3 gives the results of ANOVA with assessed system reliabilities as dependent variables and component reliabilities as explanatory variables. The ANOVA model could be represented by

$$R = \sum_{i=1}^{4} a_i r_i + \sum_{i=1}^{4}\sum_{j=1}^{4} a_{ij} r_i r_j + \sum_{i=1}^{4}\sum_{j=1}^{4}\sum_{k=j}^{4} a_{ijk} r_i r_j r_k + a_{1234} r_1 r_2 r_3 r_4$$

where

$i \neq j \neq k$

Where R is the system reliability and r_i, $i=1...4$ are the component reliabilities of the four components whose reliabilities are varied in the experiment. a_i contribute to the main effects and a_{ij}, a_{ijk} and $a_1 a_2 a_3 a_4$ contribute to the interaction effects. The reliability function as given by the model presented in Figure 2 predicts no main effects but only interaction effects.

However, there has been earlier research (documented in Ashton (1981)), notably Yntema and Torgesson (1961) which show that a linear model can "describe" the results of a purely multiplicative model quite well. To gain an insight into the decision making process, ANOVA results of the auditors' judgments are compared with the ANOVA results on the model's outputs.

Table 3A shows that when auditors' assessments are analyzed using ANOVA, the sum of squares for main effects (2.1614) is about 40 times the sum of squares for interaction effects, i.e. only 2.5% of the

variation is explained by interaction effects. Table 3B shows that when the model outputs are analyzed using ANOVA the sum of squares for main effects (.02365) is just about twice the sum of squares for interaction effects i.e., about 30% of the variation is explained by interaction effects.

Insert Table 3 here

This result suggests that the decision process employed by the auditors is substantially different in form from that of the reliability model. One implication is that reliability modeling may prove useful as a way of incorporating the compensatory relationship of activity and control reliabilities into the audit planning process.

4.2.2 Sensitivity to Component Reliabilities A final approach to evaluating the decision process of the auditor vis-a-vis the benchmark of the underlying mathematical process is to compare the auditors' sensitivity with that of the model for the same factor level changes i.e, if all other reliabilities are held constant and one component reliability is changed. The ratio (system reliability change / component reliability change) gives the sensitivity of the model to that change (under a linear approximation). This is given by column MES in Table 4. A similar mean auditor sensitivity is computed and given in the column SEN in Table 4. **SEN / MES** represent the ratio of auditor to model sensitivity. An examination of this ratio in col. 5 of Table 4 suggests that[11] auditors are consistently much more sensitive to component reliability decreases than is prescribed by the model and that the sensitivity of auditors is much more heightened for components that occur "late" in the sequence - such as vouchering.

Insert Table 4 here

4.3 Summary of Experimental Results

The following significant results are obtained from the experiment:

1. Auditors display poor calibration with the model. They significantly and consistently underestimate system reliability suggesting that the auditors do not possess a high degree of

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11. Further probe into the auditor judgment pattern was made using principal component analysis. The principal component analysis revealed that auditors gave greater importance to the vouchering stage than the ordering and receiving stages in the purchase cycle. There was no clear clustering of the auditors in the two-factor space.

expertise in aggregating component reliabilities into a system reliability measure.

2. The descriptive ANOVA results indicate that auditors place almost no emphasis on interactions between activities and controls, even when the model suggests only interaction effects. Auditors failed to recognize the compensatory nature of activities and controls. The decision model of the auditors, seemingly linear in form, differs widely from the non-linear reliability model.

3. Sensitivity analysis indicates that the auditors are more sensitive to component reliability decreases than the model. Auditors are also much more sensitive to the components that occur "late" in the sequence.

5. Conclusion

The purpose of this study was to investigate the relationship between auditor judgments and reliability-model prescriptions in the aggregation stage of the internal control process by way of evaluating the usefulness of explicitly incorporating reliability theory-based decision aids into the audit function.

The experimental results suggest that by breaking up a complex decision process into stages and systematizing the probabilistic relations between components in each stage, decisions may be improved, since auditors seem to show poor calibration with the optimal model, employing a decision process substantially different in form, in sensitivity, and in temporal weighing assigned to activities.

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TABLE 1. Test Retest Correlations

Sys.#	Correlations between ratings		Correlations between reliabilities.	
	Pearson	Spearman	Pearson	Spearman
1	0.75	0.737	0.465	0.670
2	0.863	0.910	0.750	0.845
3	0.851	0.836	0.598	0.542
4	0.873	0.879	0.882	0.880
5	0.555	0.328	0.256	0.786
6	0.752	0.741	0.443	0.435
7	0.636	0.641	0.721	0.652
8	0.589	0.436	0.803	0.781
9	0.371	0.305	0.240	0.404
10	0.524	0.531	0.762	0.623
11	0.592	0.594	0.354	0.279
12	0.500	0.471	0.671	0.709
13	0.311	0.375	0.479	0.556
14	0.288	0.271	0.613	0.600
15	0.510	0.471	0.534	0.393
16	0.721	0.755	0.628	0.673
Overall	0.759	0.751	0.649	0.715

Note: For each system, the correlations are across auditors. Overall correlation is computed across all auditors and all systems i.e., all the data points of all the 16 systems are used for this correlation. It is not the mean of the system correlations.

TABLE 2. Calibration Measures

| | ASSOCIATION | | | | BIAS | |
| | MODEL-DIRECT | | MODEL-INDIRECT | | NORM. | NORM. |
	PEARSON	SPEARMAN	PEARSON	SPEARMAN		
MEAN	0.5408	0.6476	0.5487	0.6615	0.0616	0.4079
S.DEV.	.1694	.1567	.1541	.1453	0.056	0.3708
SE OF MEAN	.019	.018	0.018	.017	0.006	0.042
T VALUE					9.65	9.65
SIG.PROB.				.01	.01	
RANGE:Max.	-.032	-.012	.233	.272		
Min.	.83	.89	.878	.917		

TABLE 3. Analysis Of Variance On System Reliabilities

Dependent Variable: System Reliability		
Factors	Levels	
V1: Preparation & Review of P.O.	.7	.98
V2: Comparison of VI to P.O. & R.R. and approval of VI.	.65	.98
V3: Voucher Preparation	.8	.99
V4: Comparison of Voucher to VI, P.O. and R.R.	.75	.98

3A: Assessed System Reliabilities

# of obs: 77 auditors*16 systems = 1232

	S.S.	DF	M.S.	F
MAIN EFFECTS	2.1641	4	.541	90.17
INTERACTION EFFECTS	.0542	11	.0049	.821

	INDIVIDUAL MAIN EFFECTS	
VARIABLE	S.S = M.S	F
V1	.1845	30.15
V2	1.0796	176.38
V3	.2480	40.51
V4	.6516	106.45

3B: Model Output

	S.S.	DF	M.S.	F
MAIN EFFECTS	.02365	4	.00591	
INTERACTION EFFECTS	.01005	11	.00091	

	INDIVIDUAL MAIN EFFECTS	
VARIABLE	S.S = M.S	F
V1	.008	9.09
V2	.011	11.87
V3	.002	2.62
V4	.002	2.32

SS = Sum of Square   MS = Mean Square
DF = Degree of Freedom   F = F Statistic

TABLE 4. Sensitivities Of Components

Procedure	Col1 DSR (Decrease in Syst. Reliab.)	Col2 DCR (Decrease In Comp. Reliab.)	Col3 SEN (Sensitivity)	Col4 MES (Model Sensitivity)	Col5 SEN/MES
Prep. & Review of PO	.1867	.28	.67	.17	3.94
Comp. of VI with PO, RR & appr.	.4485	.33	1.36	.16	8.5
Voucher Preparation	.2455	.19	1.29	.13	9.92
Comp.of Voucher with VI, PO & RR	.3735	.23	1.62	.10	16.2

LEGEND:

DSR:	Decrease in System Reliability.
DCR:	Decrease in Component Reliability.
SEN:	Sensitivity = DSR / DCR.
MES:	Sensitivity as computed by the model.

Figure 1. Stages of Decision Making in Internal Control Evaluation

Input Variables   Stage   Output Variables

1.Organizational Factors

2.Personnel related factors

3.Task Related fctors

4.Compliance Test Results

Estimation of Component Reliability

Estimated Component Reliabilities

1.Component reliability

2.Structure Function

Aggregation

Estimated System Reliabilities

1.System Reliabilities
2.Materiality Judgment
3.Tolerable audit risk Level

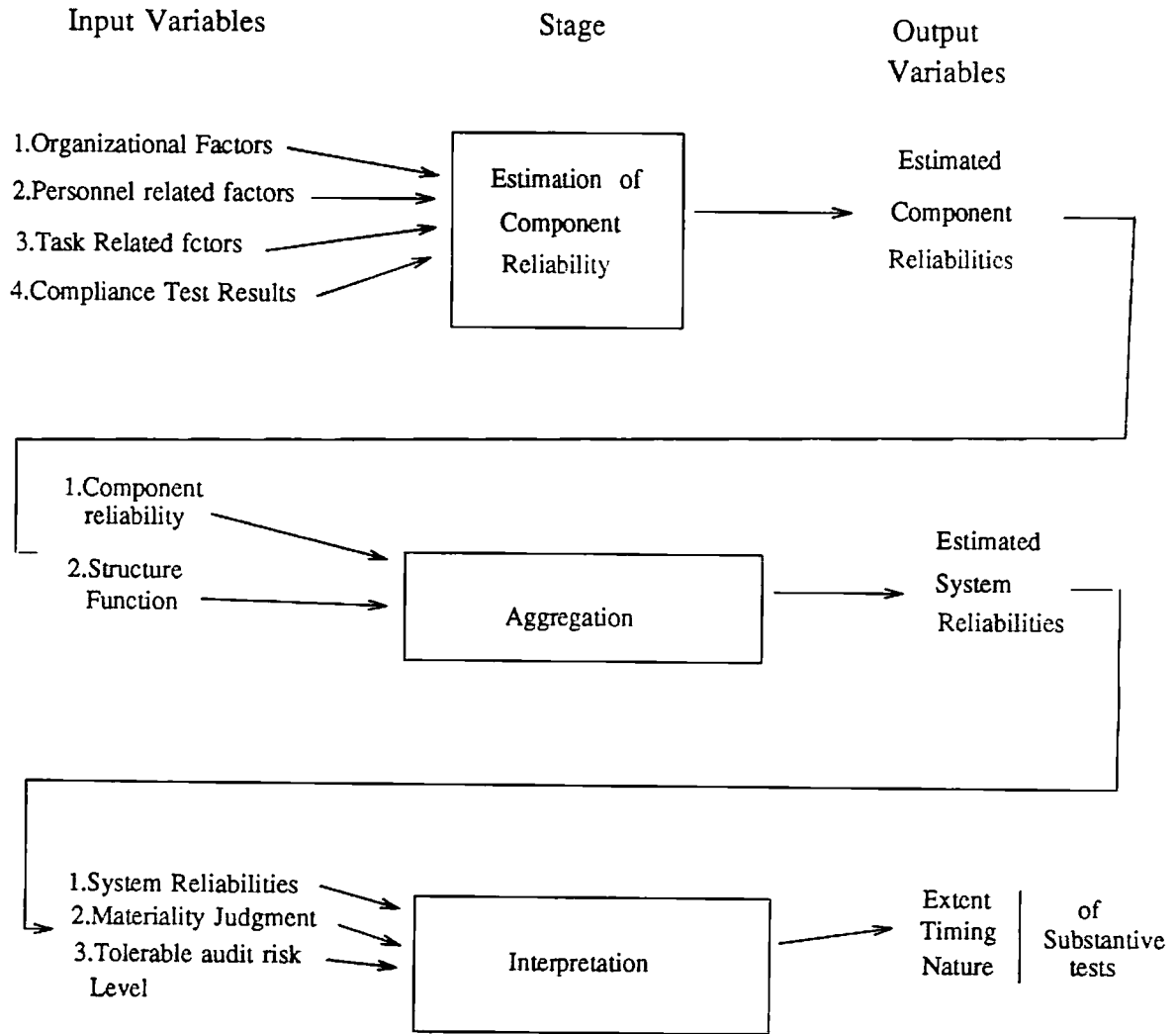Interpretation

Extent | of
Timing | Substantive
Nature | tests

Figure 2. Reliabili

Reliability = r_1
Preparation and
Order (PO)
Review of Purchase

Reliability
=constan
Preparation
Receiving R

Reliability = r_2
Comparison of Vendor's Invoice (VI) w
the PO and RR and approval of VI

The above representation implies that for the final ledge
accounts to be accurate:

i. the records all the in the supporting documents (PO

ii. the entry in the voucher register must be correct

The recording in supporting documents will be accurate if
components) or a comparison takes place and any error th
will be correct either if it is accurate in the first place or i
process.

$Reliability \ R = [1-(1-r_1 z)(1-r_2)]*[1-(1-r_3)(1-r_4)]$

$= [r_2 + r_1 z - r_1 r_2]*[r_3 + r_4 - r_3 r_4]$

$= r_2 r_3 + r_2 r_4 - r_2 r_3 r_4 + r_1 r_3 z + r_1 r_4 z - r_1 r_3 r_4 z - r_1 r_2 r_3 z.$

$= (z r_1 r_3 + z r_1 r_4 + r_2 r_3 + r_2 r_4) - (r_1 r_2 r_3 z + r_1 r_2 r_4 z + r_1 r_3 r.$

This is the reliability network for the purchase system used
presented to the participants.

Note: Preparation and Review of PO can be presented as an a
advantage of a reliability method is to enable the evaluators to c
represent. X1 can also be presented as many activities - prepar
mailing out the copies etc... or as one procedure as shown here.

APPENDIX I: Instrument Summary

1. A brief narrative of the background, organization, accounting system, and design of purchase transaction cycle using ICQ worksheets.

2. Questionnaire.

3.

    Section 1

    Given: Accuracy of performance of each accuracy and control.

    Asked: System rating - point estimate
    System rating - range estimate
    System reliability - circle one of the given numbers.

    Section 2

    Given: System reliability

    Asked: System rating.

4. *System Rating Scale:*

    0 No reliance and timing restricted to the year end.
    1 Low reliance but timing restricted to the year end.
    2 Low reliance with timing restricted to within 1 month of year end.
    3 Moderate reliance with timing restricted to within 1 month of year end.
    4 Moderate reliance with timing restricted to within 2 months of year end.
    5 High reliance with timing restricted to within 2 months of year end.
    6 High reliance with timing allowed to be more than 2 months from year end.

    System Reliability Scale

    ---100% 99.5% 99% 98% 95% 90% 85% 80% 75% 70% 50%