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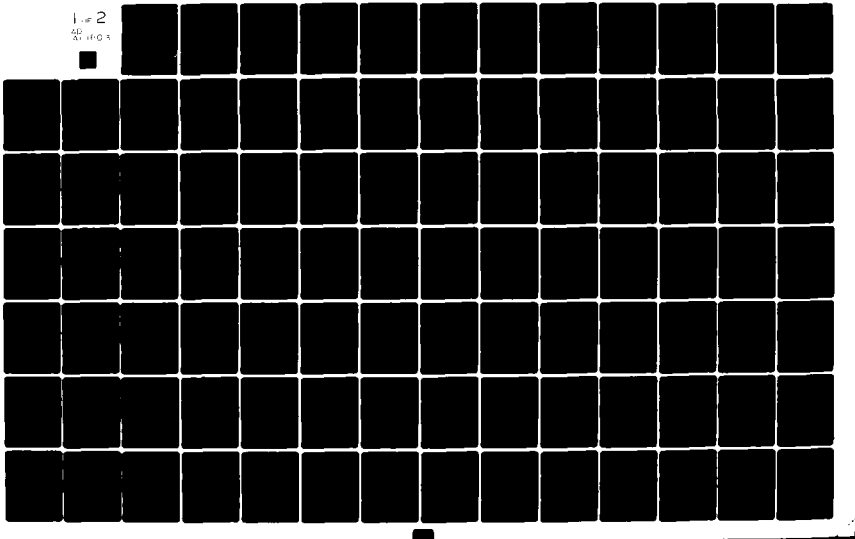

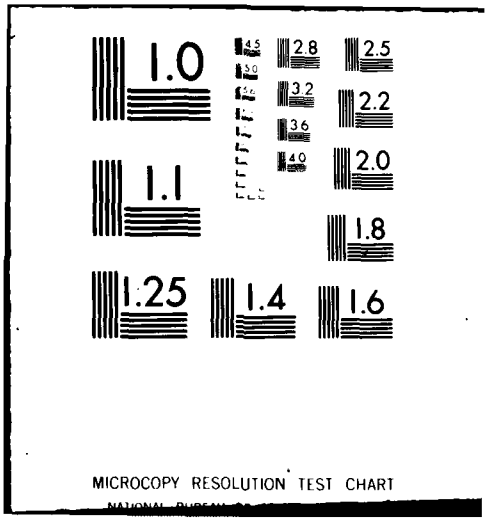
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CRITERIA FOR RECONSTITUTION OF FORCES

Technical Report 7-81

UNITED STATES ARMY

COMBINED ARMS CENTER

COMBINED ARMS
COMBAT DEVELOPMENT ACTIVITY
COMBINED ARMS STUDIES AND ANALYSIS ACTIVITY
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This report describes a study undertaken to provide assistance to commanders of units in combat in evaluating the combat effectiveness of their units and in relating effectiveness to the requirement for reconstitution. The study approach was developed in recognition that the reconstitution decision will always be judgmental, based on the commander's perceptions and weightings of both quantitative and subjective elements. Historical data on actual decisions do not fully document the prevalent conditions that influenced the decision process. However,

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Technical Report TR 7-81
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CRITERIA FOR RECONSTITUTION OF FORCES

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ABSTRACT

This report describes a study undertaken to provide assistance to commanders of units in combat in evaluating the combat effectiveness of their units and in relating effectiveness to the requirement for reconstitution. The study approach was developed in recognition that the reconstitution decision will always be judgmental, based on the commander's perceptions and weightings of both quantitative and subjective elements. Historical data on actual decisions do not fully document the prevalent conditions that influenced the decision process. However, a body of simulated decisions, made under controlled conditions, should provide an adequate basis for analysis. A set of indicators of combat effectiveness potential was developed for this study. These indicators were used in the design of a questionnaire to collect a data base of military judgment on unit combat effectiveness and the related need for reconstitution. The resulting data were analyzed, and guidelines for reconstitution decisions were proposed.

EXECUTIVE SUMMARY

1. BACKGROUND. This study was undertaken at the direction of the Commander, Combined Arms Center (CAC). The purpose was to relate the effectiveness of a unit in combat to the need for reconstitution actions that would allow the unit to continue performing its mission successfully.

2. APPROACH. The evaluation of combat effectiveness and the reconstitution decision are judgmental determinations made by the commander based on his perceptions and weightings of many indicators of the battle situation, both quantitative and subjective. The study approach was to define a set of indicators of the combat effectiveness potential of a unit in combat. Values for the indicators were then varied at several levels in the context of a basic scenario to describe the condition of the unit, each combination of the indicators representing a unique outcome of the scenario situation. These unique outcomes, or combat profiles, were then presented to groups of officers, who were asked to evaluate the combat effectiveness potential of the unit in the described situation and to decide whether the unit needed to be reconstituted. The resulting data base was analyzed to determine the factors that were most important to the officers in evaluating the effectiveness of the unit and the need for reconstitution.

a. Indicators of Combat Effectiveness Potential. A structured decision process was used to bring a group of officers to consensus on the definition of a set of indicators of combat effectiveness. The officers, from the US Army Combined Arms Combat Developments Activity and the US Army Command and General Staff College staff and faculty, recognized that in any combat situation, a large number of factors would be considered by a commander evaluating the potential of his unit to continue fighting effectively. However, the group was able to reach consensus on the following set of indicators to describe the major considerations in such an evaluation.

(1) Personnel status, primarily foxhole strength and the status of the unit's command structure.

(2) Status of the unit's major weapons and equipment and the ability of the combat service support system to perform routine resupply and repair.

(3) Status of combat support, primarily field artillery and close air support.

(4) The commander's perception of his enemy's strength, condition, and intentions.

(5) Status of intangible factors such as strength and experience of leadership, unit cohesion, troop training levels, and morale.

b. Data Collection. A scenario was prepared to describe the general and special situations of a division performing a defensive mission in Europe. The scenario was oriented specifically to a mechanized infantry battalion task force. A questionnaire was prepared consisting of profiles in which the five combat effectiveness indicators were combined at levels corresponding to high, medium, or low values for the given scenario. Thus, $3^5 = 243$ profiles were prepared to describe all possible combinations of the five indicators at three levels. The questionnaire was prepared in four forms, 60 profiles per form. The questionnaire asked the respondent officer to make two determinations for each of the 60 profiles presented to him: (1) Evaluate on a scale of 1 to 9 (low to high) the battalion's chance of success in continuing its assigned mission, and (2) decide whether the unit needs to be reconstituted. The questionnaire was submitted in April 1981 to a sample of Infantry and Armor officers in the US Army Command and General Staff College (CGSC) class. This report documents in detail the development of the questionnaire, its administration to the CGSC students, and analysis of the results. In October 1981, at the request of the Deputy Commander, US Army Combined Arms Combat Developments Activity, the questionnaire was administered to Infantry and Armor officers at the US Army War College and in the Advanced Courses at the US Army Infantry School and the US Army Armor School. Appendix C to the report documents this extension to the original study.

3. RESULTS.

a. The original hypothesis underlying this effort was that commanders who must decide when to reconstitute their units would approach the decision through an evaluation of unit combat effectiveness potential. By considering key attributes of the unit and the situation the commander would arrive at an assessment of the capability of the unit to continue performing its mission. Then, on the basis of his assessment, he would reach a decision on the need for reconstitution actions for the unit. This hypothesis is implicit in most studies of the reconstitution problem. It was expected that the commanders would develop weighting schemes or decision strategies leading them to assess the value of each indicator in the context of the total situation described by the set of indicators. Analysis of the commanders' judgments would then reveal the levels of each indicator, singly and as a set, that the commanders associated with various levels of combat effectiveness. The final step in the analysis would then relate the levels of combat effectiveness to the need for reconstitution.

b. The data base of military judgment gathered in this experiment did not support this hypothesis. In spite of written comments in which the officer respondents emphasized the importance of leadership and troop quality and enemy capabilities, the officers apparently tended not to be influenced by these indicators, or by the status of combat support, in reaching a decision on whether a unit in a described situation needed to be reconstituted. The data indicated that the officers tended to focus nearly exclusively on the status of personnel and materiel resources in reaching a decision on need for reconstitution. They considered other indicators and developed an evaluation of combat effectiveness related to need for reconstitution only when the

status of personnel and materiel resources was so ambiguous that no clear reconstitution decision based on these factors alone seemed supportable.

c. The extended analysis demonstrated that the sampled populations responded to the reconstitution questionnaire in much the same way regardless of experience levels. Personnel status was the overriding consideration for all groups in determining whether the unit in the described situations needed to be reconstituted in order to continue to perform its mission. Equipment status was also a consideration, with leadership and troop quality and enemy situation exerting slight effects on the decision. The influence of combat support status on the reconstitution decision was negligible for all respondent groups.

d. Based on the data collected and analyzed for this study, the following findings were developed:

- When personnel strength is reduced to 40 or 50 percent, decisions are needed on reconstitution actions to allow the unit to perform its mission effectively.
- When availability of major equipment is reduced to 30 or 40 percent decisions are needed on reconstitution actions to allow the unit to perform its mission effectively.
- When the commander perceives that his unit's potential for effective combat is less than 40 percent, based on his consideration of all important indicators, decisions are needed on reconstitution actions to allow the unit to perform its mission effectively.

4. OBSERVATIONS.

a. It seems obvious that all the respondent groups tended to think of reconstitution in terms of replenishment of personnel resources and that, in the much-simplified questionnaire profile situations, a low personnel status was indicative of a need for reconstitution. The other variables, which would be expected to mitigate that need in a real combat situation, apparently influenced the decisions of the respondents very little. It is problematic whether these results reflect the behavior that would be expected of the respondents in a battle situation or whether the questionnaire failed to elicit the fully reasoned decisions that it was designed to collect.

b. The extended analysis showed that both more senior and more junior officers exhibited the same tendency as the CGSC respondents to ignore combat support status in their evaluations. It was expected that the respondents would consider the availability of combat support as a resource that could, in some situations, enable the unit to continue its misison even after suffering personnel attrition. Respondents were given the opportunity to provide written comments on the questionnaire; however, very few written comments addressed specifically the value of the combat support indicator. Those that

did so tended to be negative. The extent to which this result may indicate a typical or widespread perception of the officer respondents is unknown. The profiles did not extend to a consideration of the important part that combat support would have in allowing various reconstitution operations to be conducted. In this sense, the finding should not be interpreted as a blanket dismissal by the respondents of the worth of combat support in the context of the total tactical situation.

c. The respondents apparently were influenced very little by their knowledge of threat capabilities. This could be interpreted as a lack of confidence in intelligence estimates, or it could be that the respondents were not able to develop a good appreciation of enemy condition from the information presented. More likely, the finding simply indicates a tendency on the part of the commanders to try to assure that their units are in good condition to face whatever threat develops.

d. The lack of influence of the intangible indicator, which considered the quality of leaders and troops, was surprising. Written comments of the respondents indicated that this should be an important factor, and inability to consider such intangibles is often cited as a weakness of studies using quantitative analysis. Several tacks could be taken in interpreting this result. It might be asserted that superior leadership, training, morale, and motivation are often useful in explaining the combat victories of outnumbered forces but are not so often decisive factors in planning operations. Social scientists might speculate on the finding as a comment on officer expectations as to the nature of modern combat and the importance of troop morale. A likely explanation is that the finding reflects the inability of commanders to conceptualize or grapple with the effect of intangible factors in other than an actual combat situation. If this is true, then combat simulations and war games, which rely on manipulation of the tangible factors of combat, may be somewhat exonerated since even the human commanders appeared to emphasize quantificable factors and were unable to assess the impact of intangibles in a simulated situation. The impression persists that the respondents do consider the indicator important but either could not or chose not to evaluate the impact of these more abstract factors in the hypothetical situations.

e. The weaknesses of the analysis reported herein are those inherent to the application of analytical techniques to human decision processes. Nevertheless, the study should be of value specifically to model developers as they attempt to incorporate, interactively or systemically, commander decisions relative to reconstitution operations. In a general sense, the study should contribute to an understanding of the issues involved in the development and instruction of doctrine for reconstitution of units in combat.

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CHAPTER 1

INTRODUCTION

1-1. PURPOSE. In May 1980 the Commander, Combined Arms Center (CAC) asked the Combined Arms Studies and Analysis Activity (CASAA) to address the problem of determining when units in combat should be reconstituted. Recent studies have emphasized various aspects of the reconstitution problem. Some have studied the operations to be performed in the rapid and efficient reconstitution of units. Others have identified the materiel and skill capability mixes needed to sustain performance in type units. An aspect of the reconstitution problem that has not been adequately explored is the commander's assessment of the battlefield situation and of his unit's effectiveness potential in that situation. Commander CAC felt that commanders of units in combat need assistance in evaluating the combat effectiveness of their units and criteria for relating effectiveness to the requirement for reconstitution. This study was undertaken as an initial step in meeting this need.

1-2. APPROACH.

a. The approach to the study problem was developed in recognition that the reconstitution decision will always be a judgmental one, based on the commander's perceptions and weightings of both quantitative and subjective elements. Historical data on actual decisions do not fully document the prevalent conditions that influenced the decision process. However, a body of simulated decisions, made under controlled conditions, should provide an adequate basis for analysis. Such a collection of decisions would compose a data base of commander judgment on unit combat effectiveness and the related need for reconstitution. Analysis of this data base should reveal the characteristics that commanders associate with various levels of unit effectiveness potential and how the commanders believe these characteristics relate to the need for reconstitution. These findings could be used in a preliminary development of criteria for effectiveness evaluations and reconstitution decisions. Follow-on efforts might then be conducted to test the criteria in war games and simulations for their impact on battle outcomes. Finally, the tested criteria could be provided to training and doctrine developers for implementation.

b. In accordance with the approach outlined above, a set of indicators of combat effectiveness potential was developed. These indicators were used in the design of a questionnaire to collect a data base of military judgment. The resulting data were analyzed, and guidelines for reconstitution decisions were proposed.

1-3. REPORT ORGANIZATION. Following this introductory chapter, chapter 2 of this report describes in detail the methodology for the study. Chapter 3 presents the indicators of combat effectiveness potential. Chapter 4

documents a pilot test of the reconstitution questionnaire, and chapter 5 describes the questionnaire proper. The analysis of results is reported in chapter 6, and conclusions are developed in chapter 7. Appendixes to the report include a bibliography (Appendix A) and a copy of the questionnaire (Appendix B). Appendix C documents an extension to the analysis that was tasked following the completion of the work described in the main report.

CHAPTER 2

METHODOLOGY

2-1. OBJECTIVES. As described in chapter 1, the purpose of this analysis was to give commanders of units in combat a set of criteria for deciding whether reconstitution actions are required. Once a unit becomes combat ineffective, reconstitution actions must be taken if the unit is to be returned to a desired level of combat effectiveness. Thus, the decision criteria should consider the potential of the units to continue effective performance of their combat roles. Accordingly, the objectives of the analysis were stated as follows:

a. Develop key indicators of combat effectiveness potential. The indicators may be either tangible (amenable to quantification) or intangible (related to such areas as leadership and morale).

b. Evaluate the indicators, individually and as a group, for their relationship to the need for reconstitution.

c. Formulate criteria, based on the indicator range values, for determining that reconstitution decisions are required.

2-2. ESSENTIAL ELEMENTS OF ANALYSIS (EEA). The preceding objectives were further refined in the following EEA:

a. EEA 1. What unit and situational attributes are critical to the ability of a maneuver battalion to continue effective combat performance?

b. EEA 2. What relative values of these attributes, in what combinations, indicate that a maneuver battalion can (cannot) continue to perform effectively?

c. EEA 3. What decision rules can be formulated for commander use in determining that a maneuver battalion must be reconstituted in order to remain combat effective?

d. EEA 4. What warning points can be developed to indicate to the commander that a maneuver battalion is approaching ineffectiveness and that a reconstitution decision will have to be made?

2-3. SCOPE.

a. For purposes of this study, reconstitution is understood to mean non-routine actions taken to restore attrited units to a desired level of combat effectiveness. This definition emphasizes that reconstitution involves more than normal internal resupply and replacement actions. Reconstitution applies to units that have become marginally or completely incapable of continuing to perform their assigned combat roles effectively. Typical types

of reconstitution actions included in this definition might be unit replacement, reorganization, and redistribution. However, this analysis focuses on a unit's need for reconstitution based on its combat effectiveness potential. The analysis does not consider how the reconstitution should be accomplished. Also, the analysis does not consider decisions on whether a given reconstitituion action should be undertaken; that is, the costs and payoffs associated with a unit reconstitution in the context of the total force situation are not addressed. The perspective of the analysis, therefore, is that of the battalion commander evaluating the effectiveness potential of his unit and determining whether, from his viewpoint, some reconstitution action is required to enable him to continue to perform his mission.

b. The analysis considers a ground maneuver unit engaged in a defensive operation. The general methodology is applicable to other type units and also to other scenario situations. Only slight modifications would be required to collect the data bases necessary to extend the analysis.

2-4. REVIEW OF LITERATURE. Appendix A contains a list of references pertinent to the study. Most of the documents listed pertain to the determination of combat effectiveness of a force and were used in the development of combat effectiveness indicators (chapter 3). The military literature on reconstitution is concerned primarily with description of the operations to be accomplished in reconstituting units. The decision process; i.e., the determination of the point at which a unit must be reconstituted in order to remain combat effective, is not emphasized.

a. One of the most relevant works found in this area is the report New Approaches to Reconstitution in High Intensity Conflict on the Modern Battlefield, BDM Corporation, March 1980. Among the objectives of this study was the identification of how and at what times in the course of combat operations various reconstitution options could best be carried out. The study proposed a number of indicators that could be used to determine combat effectiveness but stated that commanders must decide when a unit is capable of accomplishing its assigned mission and when it is not. The study asserts that no formula can be constructed to serve as a panacea, primarily because the indicators consist of both tangibles and intangibles and the interaction between the two precludes quantifiable guidelines. The study concluded in this regard that a new methodology is needed to provide commanders with the essential elements of information they require to make decisions in a timely manner. The study proposed a standardized reporting system that would allow commanders to make timely assessments of the status of tangible indicators.

b. Another relevant work is the Study of Sustainable Loss Rates, Science Applications, Inc., draft final report, February 1981. This study employed the Analysis of Military Organizational Effectiveness (AMORE) methodology to investigate the response of several unit types to losses of personnel and materiel and to provide information on the ability of those units to sustain operational capability following losses. AMORE determines unit capability as

a function of time following a wide range of losses. The methodology requires extensive data input, including definition of personnel and equipment teams essential for mission accomplishment by unit type, determination of personnel and materiel damage combinations for each team, identification of feasible equipment and personnel substitutions after damage has been sustained, and the times required to make these substitutions.

c. These efforts and the subject study are complementary in the sense that each approaches the reconstitution problem from a different, but compatible, aspect. Each attempts to provide information on which to base reconstitution decisions. The BDM study emphasizes improving the reporting system. The AMORE methodology attempts to characterize units by their capability to recover from losses. The subject study determines the components of combat effectiveness that commanders tend to weigh in their assessments. Then it proposes guidance for reconstitution decisions based on the imprecise information on these components likely to be available to the commander in combat.

2-5. PLAN OF ANALYSIS.

a. The procedure for collecting the judgmental data base involved design of a questionnaire and its subsequent administration to a group of combat arms officers. The questionnaire provided the respondents with a scenario describing the general and special situations of a battalion task force taking part in a defensive operation. Five indicators of combat effectiveness potential (chapter 3) were then defined for the respondents. These five indicators were manipulated at three different levels corresponding to "high," "medium," or "low" in the context of the scenario. This procedure defined $3^5 = 243$ unique combinations, each representing a different possible outcome to the scenario situation. Each unique combination was referred to as a "combat profile."

b. Each respondent was given a number of profiles and was asked to assume the role of the battalion task force commander. He was asked to assess the capabilities of his unit under the conditions described by the profile and to answer two questions for each profile. First, the respondent was asked to rate the battalion's chance of success in continuing its assigned mission given the presented situation. Responses were collected using a 9-point scale. The second question, posed as a dichotomy, asked the respondent for a decision on whether the unit in the presented situation needed to be reconstituted.

c. Thus, the analysis considered two dependent variables: (1) the respondent's rating of the unit's chance of success, and (2) the decision on whether reconstitution is needed. Independent variables were the five combat effectiveness indicators varied at three levels. In addition, information was collected on the respondents (e.g., combat branch, rank, command experience).

d. The following chapter describes the indicators of combat effectiveness potential. Subsequent chapters describe the pilot test and the administration of the questionnaire. Chapter 6 then presents the analysis of the resulting data base.

CHAPTER 3

INDICATORS OF COMBAT EFFECTIVENESS POTENTIAL

3-1. INTRODUCTION. The definition of key indicators of combat effectiveness potential for use in the questionnaire was a critical part of the study. CASAA was assisted in this effort by the US Army Research Institute (ARI) Field Unit at Fort Leavenworth. The procedure was generally one of attempting to bring a group of officers to consensus through a structured, iterative process. A multitude of factors will enter into any command decision on reconstitution under battlefield conditions. Since each indicator was to be varied at three levels, five indicators, for a total of $3^5 = 243$ combinations, was accepted as the upper limit bounding the number that the analysis could accommodate. (The addition of even one more indicator would have resulted in $3^6 = 729$ combinations.) The problem then was to reach consensus in structuring a set of five effectiveness indicators that would encompass as nearly as possible the attributes of the unit and the situation that are most critical in determining effectiveness potential.

3-2. PROCEDURE. ARI team members identified and reviewed several documents pertaining to combat effectiveness (Appendix A, References). They extracted from these documents the effectiveness descriptors proposed by the various authors. These lists of descriptors were given to a group of military officers who were asked to devise their own list of five indicators for ground maneuver units and the components of each. The group recognized that in any combat situation a large number of factors would be considered by a commander evaluating the potential of his unit to continue fighting effectively. However, in subsequent meetings, the group was able to reach a consensus on a set of indicators describing the major considerations in such an evaluation.

3-3. EFFECTIVENESS INDICATORS. The five indicators of the potential of maneuver units to continue effective performance as defined for this study were as follows:

- Personnel status
- Status of weapons, equipment, supplies, and combat service support capability
- Combat support status
- Enemy strength and condition
- Leader and troop quality

a. Indicator 1 - Personnel Status. The status of the battalion's personnel has a direct impact on its ability to continue to fire and maneuver. This indicator includes consideration of personnel strength remaining as noncasualties, especially within the combat elements of the

battalion (the "foxhole" strength). It also takes into account the command structure remaining in the battalion headquarters, companies, and platoons.

b. Indicator 2 - Status of Weapons, Equipment, Supplies, and Combat Service Support Capability. This indicator considers the operability of the battalion's major weapon systems and vehicles and its communications capability. It takes into account the ammunition and POL supplies remaining in the unit and the capability of the division's combat service support system to resupply the battalion and to repair or replace its damaged weapons and equipment.

c. Indicator 3 - Combat Support Status. The availability of combat support may be critical to the ability of the maneuver battalion to continue its assigned mission. This indicator considers specifically the field artillery support and the Army air and close air support available to the battalion.

d. Indicator 4 - Enemy Strength and Condition. The commander's perception of his enemy's strength, effectiveness, and intentions is critical to his assessment of his own unit's capabilities. This indicator covers those aspects of the battle situation.

e. Indicator 5 - Leader and Troop Quality. In addition to the tangible indicators described above, the commander must consider a number of subjective factors that bear on the ability of his unit to continue its assigned mission. Among the most important of these intangible indicators is the quality of the unit's leaders and troops. This indicator considers the quality of leadership in the unit as manifested in such attributes as technical and organizational skills, facility in interpersonal relations, and problem-solving ability. Troop quality is considered in terms of such attributes as discipline, job proficiency, group cohesion, and morale.

3-4. INDICATOR LEVELS. After the set of indicators was established, the next step required by the analysis was the definition of the status of each indicator that, in the given scenario situation, could be characterized as high, medium, or low. One of the primary concerns was the magnitude of the task that would be given to the questionnaire respondents. The goal was to present enough information to enable the respondents to make confident assessments without providing so much material that fatigue would become a factor or that tolerance levels would be exceeded. The study team also felt that a narrative presentation of the indicators composing the profiles would elicit more thoughtful responses than would other formats, such as bar graphs or coded presentations. This issue was one of those addressed in the pilot test of the questionnaire (chapter 4). The narrative statements devised to characterize a high, medium, or low status for each of the indicators are shown in table 3-1.

Table 3-1. Combat effectiveness indicators for reconstitution questionnaire. (Continued next page)

Personnel Status

(High) Foxhole strength is 90%, and the chain of command is essentially intact.

(Medium) One field grade officer was lost, but 70% of the company command structure is intact and foxhole strength is at 65%.

(Low) More than half the battalion's leaders were lost, and foxhole strength is less than 40%.

Equipment, Supply, CSS Status

(High) Major weapons and equipment are operable, and refuel/resupply assets are intact and functioning.

(Medium) 55% of the battalion's major weapon systems are operable, and refuel/resupply systems are functioning but availability is curtailed.

(Low) Less than 30% of major weapon systems are operable, and refuel and resupply assets are not functioning.

Combat Support Status

(High) The battalion has priority of fires from DS artillery, and close air support and Army air are on call as needed.

(Medium) Fire support is available on call from one FA battalion, and close air support mission response has been about 50%.

(Low) The battalion does not have priority for DS assets, and close air support is not available.

Enemy Strength

(High) The enemy is reported to be at 85% strength and capable of a fully supported attack.

(Medium) The enemy is perceived to be at about 65% strength with limited offensive capability.

(Low) The enemy is perceived to be at less than 50% strength and to have little capability for offensive action.

Table 3-1. Combat effectiveness indicators for reconstitution questionnaire. (Concluded)

Leadership/Troop Quality

(High) Troops are well trained, leaders are experienced, and morale is high.

(Medium) Training and morale among troops is about average, and leaders have various levels of experience.

(Low) Training and experience levels among troops and leaders is low, and morale is poor.

CHAPTER 4

QUESTIONNAIRE PILOT TEST

4-1. INTRODUCTION. Several issues pertaining to the design and administration of the reconstitution questionnaire needed to be resolved before the package was prepared and presented to the respondents. In addition, the larger issue of validity of the questionnaire concept needed to be tested. These issues were addressed in a pilot test of the questionnaire.

4-2. PILOT TEST ISSUES. The issues to be clarified by the pilot test were in three major areas:

- What combined arms branches and ranks should questionnaire respondents represent?
- What profile format should be used to elicit the most valid and reliable responses from the respondents?
- Is the questionnaire adequate and reliable?

4-3. PILOT TEST QUESTIONNAIRE. The pilot test questionnaire was administered to 22 military officers assigned to the US Army Combined Arms Combat Developments Activity (CACDA). Officer ranks and branches were distributed as shown in table 4-1. The respondents were given a short briefing on the purpose of the pilot test and procedures for the questionnaire. Each respondent was given a questionnaire package consisting of instructions, the scenario, and 82 profiles. Half the profiles in each package used the narrative statements shown in table 3-1 to describe the indicators. The remaining profiles were presented in the short format shown in table 4-2. These profiles were accompanied by a key associating the high, medium, and low designations to narrative descriptions. In half the questionnaire packages the narrative profiles were presented first; in the remaining packages the short form profiles appeared first. Following the profiles was a set of questions on the repondent's command and combat experience and on his reactions to the questionnaire. Respondents were also encouraged to provide written comments. The respondents were able to complete the questionnaire with little or no clarifying discussion in less than 2 hours.

4-4. PILOT TEST RESULTS.

a. Questionnaire Concept. A major issue for the pilot test was whether the questionnaire concept was a valid and adequate approach to the study objectives. The criterion established was that at least 50 percent of the dependent variable variance should be explained by the independent variables for the instrument to be acceptable. A multiple regression analysis was performed, with the dependent variable being the rating of the unit's chance of continuing its current mission and the independent variables being the five manipulated indicators. The squared multiple correlation

Table 4-1. Pilot test questionnaire respondents.

Branch	Rank				
	CPT	MAJ	LTC	COL	Total
Infantry	2	5	1	0	8
Armor	0	0	2	0	2
Field Artillery	1	1	2	0	4
Air Defense	2	0	2	0	4
Engineer	0	1	1	0	2
Military Intelligence	0	0	0	1	1
Chemical	0	0	1	0	1
Total	5	7	9	1	22

Table 4-2. Example short format profile.

Personnel Status	Equipment, Supply & Combat Service Support Status	Combat Support Status	Enemy Strength	Leadership/ Troop Quality
High	Medium	Low	High	Medium

coefficient, computed in conjunction with the regression equation, was .65. This result led to the conclusion that the questionnaire was acceptable for use.

b. Profile Formats. Six profiles were duplicated in the two formats; that is, six of the unique combinations of the independent variables presented in the narrative format were also presented in the short format. Means and standard deviations were calculated for the common items, and no statistical difference was found in responses between the two formats. The respondents were asked which of the two formats caused them to give the most thoughtful and realistic responses. Of the 19 responding to this question, 15 selected the narrative format. In written comments, several noted that the short format was faster and easier to handle but that responses in this format tended to be mechanical; responses were more carefully thought out in the narrative format. These findings led to selection of the narrative format for presentation of all combat profiles in the questionnaire proper.

c. Respondent Qualifications. The small sample size precluded any rigorous testing of differences in responses due to level or duration of command and combat experience. However, based on standard measures of dispersion, no significant differences were found in responses by military rank of respondents. With respect to branch affiliation, respondents were divided into two groups: maneuver (infantry and armor) and other. No statistical differences were found in responses from these two groups. The questionnaire asks the respondent to assume the perspective of the commander of a mechanized infantry battalion task force, and preliminary planning for the questionnaire had focused on students in the US Army Command and General Staff College as the target population. In the absence of any contrary findings in the pilot test, majors in the Infantry and Armor branches in the Command and General Staff College class were selected as respondents for the questionnaire.

d. Other Issues. Reactions and comments of pilot test respondents led to other refinements in plans for questionnaire administration. Over 80 percent of the respondents felt that the instructions were clear, the scenario was adequate to its purpose, and the indicators were suitably defined. These results tended to reinforce the acceptability of the concept. The pilot test consisted of 82 profiles. In response to a question on how many profiles respondents should be asked to evaluate, half answered 80 or more and half answered fewer than 80. This inconclusive result led to a decision to limit to 60 the number of profiles that any one respondent would be asked to assess.

4-5. SUMMARY. The pilot test results reinforced credence in the questionnaire concept. With the refinements resulting from the pilot test experience, the questionnaire proper was administered and the results analyzed as described in the following chapters.

CHAPTER 5

QUESTIONNAIRE ADMINISTRATION

5-1. THE QUESTIONNAIRE PACKAGE.

a. The final questionnaire package was prepared in accordance with pilot test experience. A brief summary of the purpose of the questionnaire was given, followed by a description of procedures. The reconstitution issue was defined, and the five key indicators of combat effectiveness potential were described. The scenario providing the context for respondent evaluations was presented, and specific instructions for completing the questionnaire were given.

b. The bulk of the questionnaire package consisted of the profiles themselves. Since each respondent was to be asked to evaluate only 60 profiles, four different questionnaire packages, each containing a set of 60 unique profiles, were prepared. In this way 240 of the total of 243 combinations of indicators were presented for evaluation.

(1) A sequential random sampling procedure was used to help assure an equitable distribution of profiles across the four packages. Each profile was given a value based on the total of the levels of the indicators composing it (high = 3, medium = 2, low = 1). The profiles were then rank ordered and distributed among four groups. The profiles within each group were ordered randomly. The groups were also checked to assure that none contained a preponderance of any one indicator at a single level.

(2) Results of statistical tests on the reliability of the four questionnaire forms are reported in chapter 6.

c. Following the profiles was a set of questions on the military experience of the respondents and their reactions to the questionnaire. Space was also provided for written comments. A cover letter from Commander, CAC completed the package.

d. A copy of the questionnaire package appears at appendix B. To minimize report volume, only a few of the combat profiles are included.

5-2. ADMINISTRATION.

a. A sample size of 120 respondents, 30 for each questionnaire form, was determined to be adequate for analysis purposes. The Internal Evaluation and Assessment Division of the Command and General Staff College (CGSC) acted as liaison with the CGSC Class Director, who made a random selection of 120 Infantry and Armor officers in the 1980-81 CGSC class to receive the questionnaire.

b. Based on pilot test experience, it was determined that instructions and procedures were clear enough that it was unnecessary to assemble the respondents for briefings and administration of the questionnaire under controlled conditions. Accordingly, the Class Director distributed the packages to respondents, to be completed and returned within four days.

c. Of the 120 questionnaires distributed, 119 were completed and returned. These 119 questionnaires composed the data base that was analyzed as reported in chapter 6.

CHAPTER 6

ANALYSIS OF QUESTIONNAIRE DATA

6-1. INTRODUCTION. This chapter documents the various analyses that were performed on the questionnaire data. The informational data collected from the respondents is reported first, followed by a discussion of respondent comments. Descriptive statistics calculated for the data are presented. An exploratory analysis is described, in which some preliminary indications of the relationship of the independent variables to the reconstitution decision were obtained. A path analysis is reported, in which a causal model was developed to identify the direct and indirect effects of the five indicators on the decision that unit reconstitution is needed. A cluster analysis is then described, which categorizes respondents according to their relative tendencies to decide in favor of reconstitution. Preliminary findings are developed as appropriate with the discussions of the analyses. These findings are then summarized in terms of the study's essential elements of analysis (EEA) in chapter 7. (Note: Appendix C documents an extension to the analysis in which the questionnaire was administered to student officers at the US Army War College and the Advanced Courses at the US Army Infantry School and US Army Armor School.)

6-2. INFORMATIONAL DATA.

a. Information was collected on respondent rank, branch, highest level staff position held and duration, command time, and duration of combat experience. This information is summarized in table 6-1.

b. Respondents were given a series of multiple choice questions relating to their opinions of the questionnaire instructions, the scenario, and the indicators and their definition. They were also asked how confident they were of their evaluations. Responses to these questions are summarized in table 6-2.

6-3. RESPONDENT COMMENTS. Fifty-seven of the 119 respondents, or 48 percent, provided written comments on their questionnaire forms. The comments in general revealed a diversity of opinion on the commander's approach to reconstitution and the relative importance of the issues involved. The following examples illustrate this diversity:

- "75 percent weight should be given to percent personnel strength, 25 percent to morale. Vehicle status is a maintenance/supply problem. Reconstitution is personnel."
- "I believe leadership/troop quality to be the most important and enemy strength to be least important."
- "My assumptions were that 50 percent officer losses and 40 percent field artillery support and/or 30 percent or less in equipment require reconstitution of some type."

Table 6-1. Summary of respondent military experience.

Number of Respondents: 119

Rank: LTC - 1, MAJ - 118

Branch: Infantry - 75, Armor - 42, No Response - 2

Highest Level Staff Position:

Level	Number of Respondents	Average Duration in Months
Corps	16	19
Division	33	17
Brigade	24	12
Battalion	35	17
None or No Response	11	--

Command Time: Average duration in months - 28

Combat Experience:

Level	Number of Respondents	Average Duration in Months
Yes	101	14
None or No Response	18	--

Table 6-2. Summary of responses to informational questions

Questions	Number of Respondents	Percent
Written instructions were given to you with the questionnaire. How clear were the instructions?		
Not clear at all	0	0
Somewhat unclear	4	3
Unsure	2	2
Adequate	76	64
Very clear	35	29
No response	2	2
A scenario was given to you to provide the context for your evaluations. How adequate was the scenario for this purpose?		
Totally inadequate	3	3
Inadequate	6	5
Unsure	8	7
Adequate	92	77
More than adequate	7	6
No response	3	3
A set of five indicators of combat effectiveness potential was identified for this task. Do you agree that these indicators, in general, are the right ones for determining combat effectiveness potential in a combat situation?		
Strongly disagree	4	3
Disagree	1	1
Unsure	11	9
Agree	89	75
Strongly agree	10	8
No response	4	3
Was the information given to you about the indicators in the profiles adequate for you to make the evaluations asked for?		
Totally inadequate	2	2
Inadequate	9	8
Unsure	9	8
Adequate	89	75
More than adequate	5	4
No response	5	4
How confident are you that your evaluations for the pfofiles were accurate and realistic?		
Not at all confident	4	3
Somewhat unconfident	5	4
Unsure	25	21
Fairly confident	67	56
Confident	16	13
No response	2	2

- "My feeling of importance of factors is (1) our strength, (2) our weapon systems, (3) enemy strength, (4) our morale, (5) supporting arms."
- "Evaluations were determined on the basis of what point would the entire unit perceive that they will lose or be killed at the next attack."
- "I would weight the indicators as follow: enemy strength/capability - 5, training/morale - 4, other three - 2."
- "The key questions are morale, leadership, trust, training, equipment, troop strength, and experience."
- "Normally, I would not reconstitute a unit (company or battalion) which has an intact chain of command and sound morale."
- "If personnel or major weapons falls below 50 percent we should consider reconstitution, regardless of the enemy capabilities at any given time."
- "I feel the capability of the enemy was of major concern in all given scenarios."
- "Probably could eliminate enemy capabilities (as an indicator) when considering a unit."
- "I put a lot of emphasis on morale."
- "In order of priority for which I sought a solution was: (1) leadership/troop quality, (2) equipment, supply, CSS status, (3) combat support status, (4) enemy strength, (5) personnel status."
- "The key factors I considered were troop strength (less than 40 percent) and weapons systems (less than 30 percent) then you must reconstitute but both must be present."
- "Obviously, high morale and effective leaders are, by far, the most important factors and have the most bearing on reorganization."
- "Foxhole strength, leadership strength, major weapons systems are important along with ammo and fuel resupply. Morale is transient and can be changed by a good leader."
- "The real discriminator was troop strength."

These comments are perhaps indicative of various command styles; however, they are also indicative of the complexity of the reconstitution question and the decision processes involved. The following analysis shows how most of the respondents related the key indicators to the evaluation of combat

effectiveness potential and the need for reconstitution. As such, it should be of interest to commanders in comparing their own priorities to those of the respondents. Developers and instructors of doctrine may also find the results of interest as they are perceived to reveal strengths and weaknesses of existing programs.

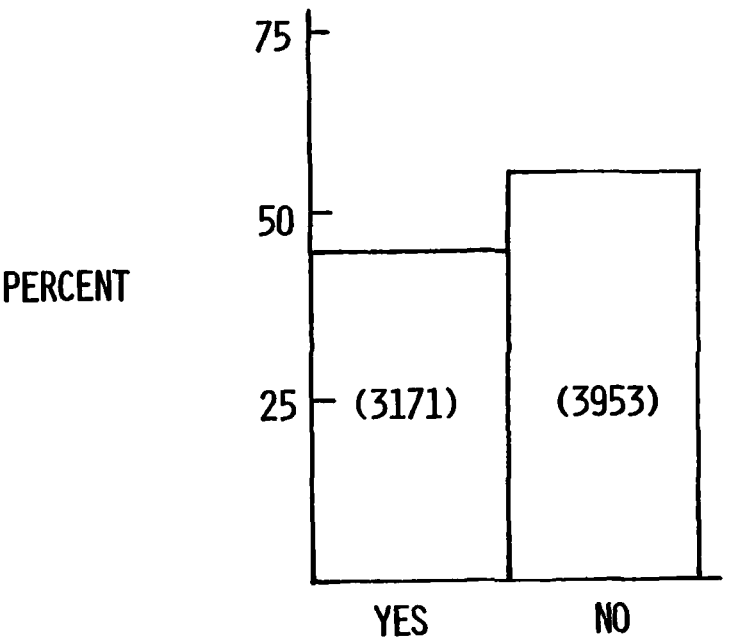
6-4. DESCRIPTIVE STATISTICS.

a. The 240 combat profiles presented by the questionnaire contained most of the possible combinations of the five indicators at three levels, and it was expected that the decision on need for reconstitution would be approximately equally distributed for the dichotomy. The total number of possible reconstitution decisions was 119 x 60 = 7140. Sixteen decisions were missing from the data, leaving a total of 7124. Figure 6-1 shows that 3171 of these decisions, or 44.5 percent, were that reconstitution is needed; 3953, or 55.5 percent, were that reconstitution is not needed.

b. A total of 7137 ratings were obtained on the unit's chances of being able to continue its mission successfully under the conditions presented by the profiles. These ratings of the unit's combat effectiveness potential were collected on a scale from 1 to 9. Figure 6-2 shows that the ratings approached a normal distribution. The mean effectiveness rating was 5.44 with a standard deviation of 1.86. Table 6-3 illustrates further that the entire scale was used in the effectiveness ratings. The profile in which all the indicators were favorable to the evaluated unit received the highest ranking, with a mean of 8.700 and a standard deviation of .596. The profile in which all indicators were unfavorable received the lowest ranking, with a mean of 1.967 and a standard deviation of 1.033.

c. Figure 6-3 shows a plot of the decisions on need for reconstitution versus the effectiveness ratings. The plot shows that for effectiveness ratings from 1 to 4, most respondents felt that the unit needed to be reconstituted. For ratings from 6 to 9, most decided that the unit did not need reconstitution. The area of effectiveness ratings of from 4 to 6 was obviously an area of uncertainty on the need for reconstitution. The plot also shows that even with high effectiveness ratings of 7 to 9, some respondents felt that reconstitution was needed; and, at the other extreme, even with low ratings from 2 to 4, some decided that reconstitution was not needed. Figure 6-4 shows the same data plotted as a cumulative distribution. The area of uncertainty from 4 to 6 on the effectiveness rating scale is again appparent, along with the decision extremes. These aspects of the data are investigated further in subsequent analyses.

d. The reliability of each of the four questionnaire forms was examined using the RELIABILITY subprogram of the computerized Statistical Package for the Social Sciences (SPSS). The rating of unit effectiveness served as the dependent variable in this analysis. The four alpha reliabilities for the forms A, B, C, and D were .962, .951, .955, and .932, respectively.



N = 7124 MISSING = 16

Figure 6-1. Decisions on need for reconstitution.

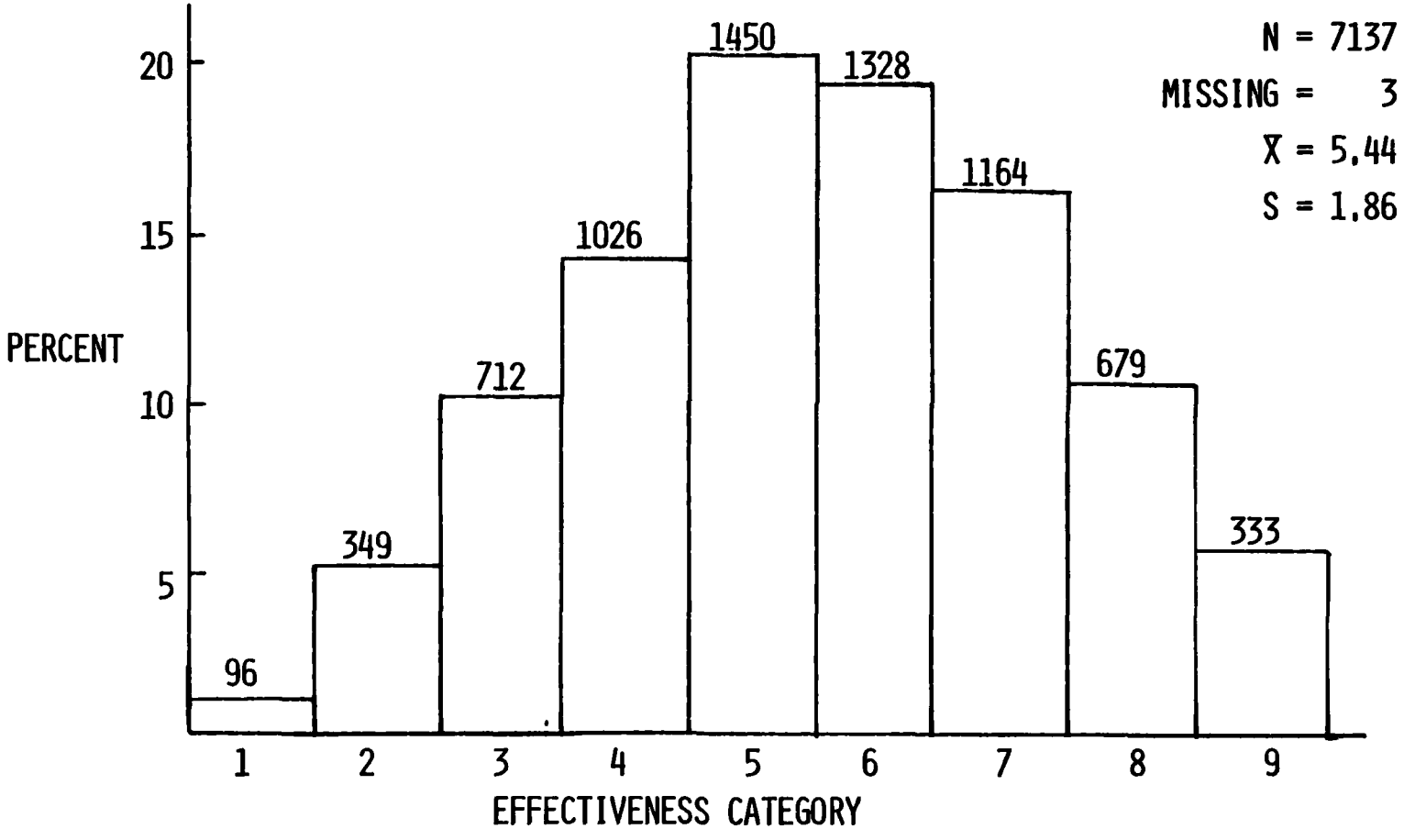


Figure 6-2. Ratings of combat effectiveness potential.

Table 6-3. Profile extremes.

	Highest Ranking Profile	Lowest Ranking Profile
Personnel	High	Low
Equipment	High	Low
Combat Support	High	Low
Enemy Situation	Low	High
Leadership/Troop Quality	High	Low
Mean Effectiveness	8.700	1.967
Standard Deviation	.596	1.033

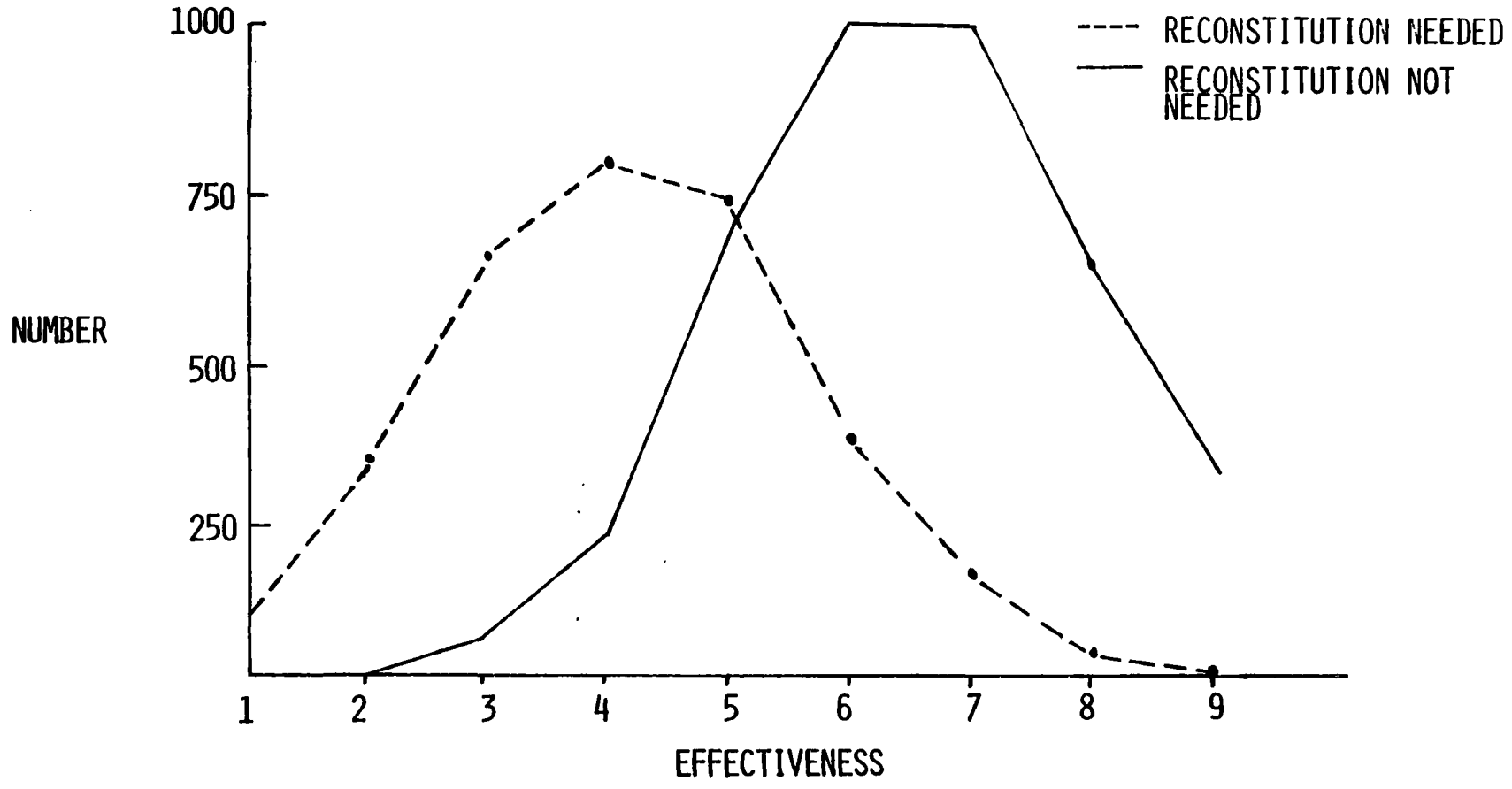


Figure 6-3. Need for reconstitution versus effectiveness ratings.

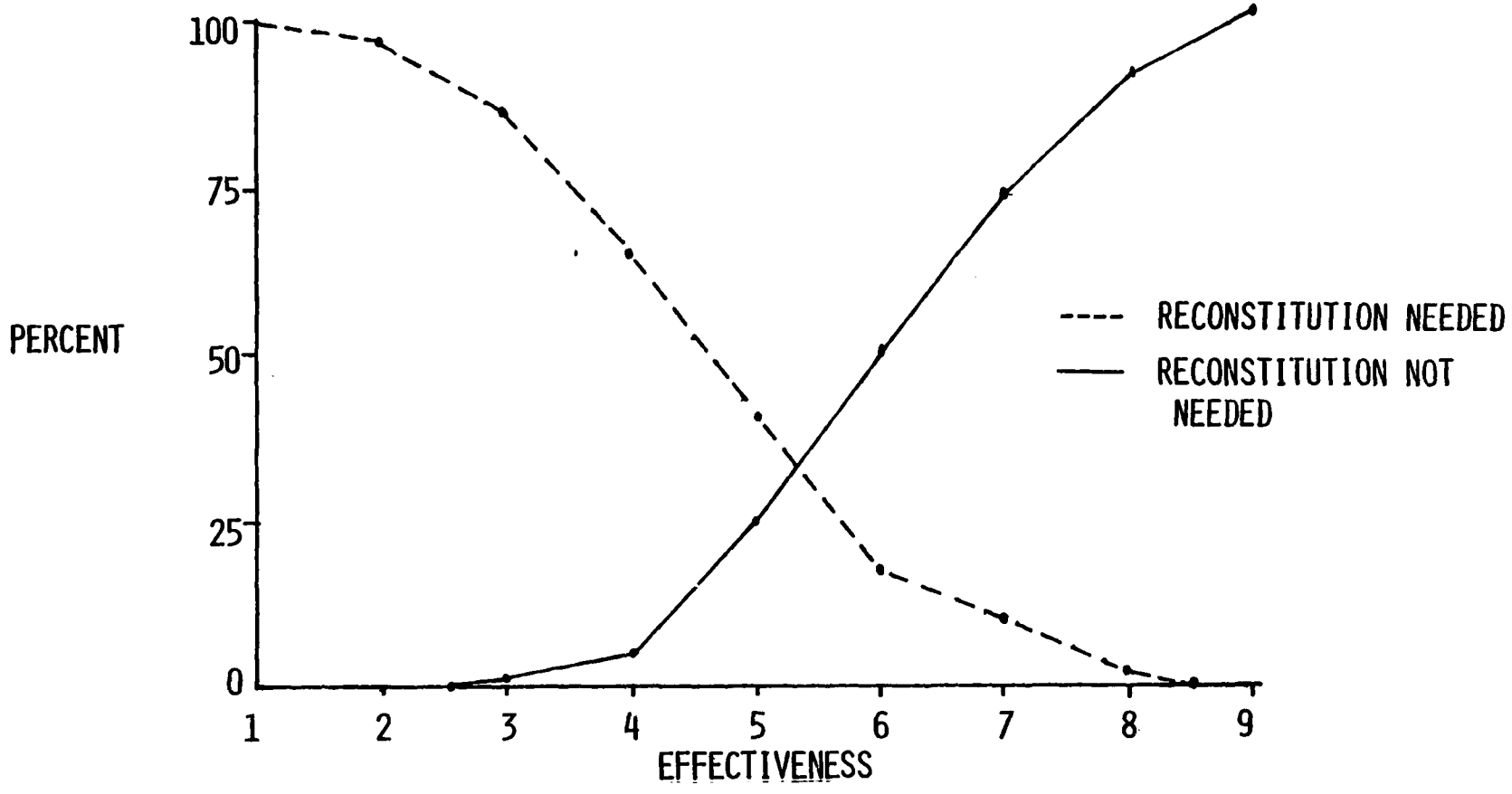


Figure 6-4. Cumulative distribution of need for reconstitution versus effectiveness ratings.

6-5. EXPLORATORY ANALYSIS. The questionnaire data were subjected to an exploratory analysis to develop preliminary insights into the indicators, indicator levels, and combinations that influenced most strongly the respondent's judgments on the need for reconstitution in the questionnaire profiles.

a. Approach. The responses to the reconstitution question for each of the 240 profiles were tabulated and then recorded as the measure, Percent of Respondents Answering Yes to Reconstitution Question (the unit in the described situation does need to be reconstituted). The profiles were then grouped in 20 percent intervals; e.g., all those for which the measure fell in the range 80 to 100 percent, those for which the measure fell in the range 60 to 79 percent. Each group of profiles was then characterized by the values of the indicators composing them.

b. Results.

(1) Figure 6-5 shows the number of profiles falling into the various 20 percent intervals for the percent of respondents answering yes to the reconstitution question. Note that the profiles falling on the left side of the figure are those for which most respondents felt that reconstitution was needed; those on the right are those for which most respondents determined that reconstitution was not needed. Forty-eight profiles were judged by 80 percent or more of the respondents to need reconstitution. Fifty-four profiles were judged to need reconstitution by 60 to 79 percent of respondents. Thus, a total of 102 profiles, or 43 percent, were determined by 60 percent or more of the respondents to need reconstitution. To the right of the figure, it can be seen that 88 profiles were determined by less than 20 percent of the respondents to need reconstitution, or, stated another way, over 80 percent of respondents felt that these 88 profiles described situations in which the unit did not need to be reconstituted. An additional 16 profiles were judged by 61 to 80 percent of respondents not to need reconstitution. Thus, a total of 104 profiles, or 43 percent, were determined by over 60 percent of the respondents not to need reconstitution. Thirty-four profiles, or 14 percent of the total, fell into the 40 to 59 percent range, indicating that respondents were nearly evenly divided on whether these profiles needed reconstitution.

(2) Figures 6-6 through 6-10 show the levels of the five indicators in the profiles composing each group.

(a) Looking at the right side of figures 6-6 and 6-7, it can be seen that the 88 profiles determined by most of the respondents not to need reconstitution had both the personnel and the equipment indicators at either the high or the medium levels. Figures 6-8, 6-9, and 6-10 show that the other three indicators were fairly evenly divided among the high, medium, and low levels for these 88 profiles. Fifteen of the 16 profiles in the next group also had either high or medium levels of personnel and equipment (one had a low level for the equipment indicator). Thus, 103 of the 104 profiles considered by over 60 percent of the respondents not to need reconstitution were those profiles having personnel and equipment indicators at various combinations of high and medium levels.

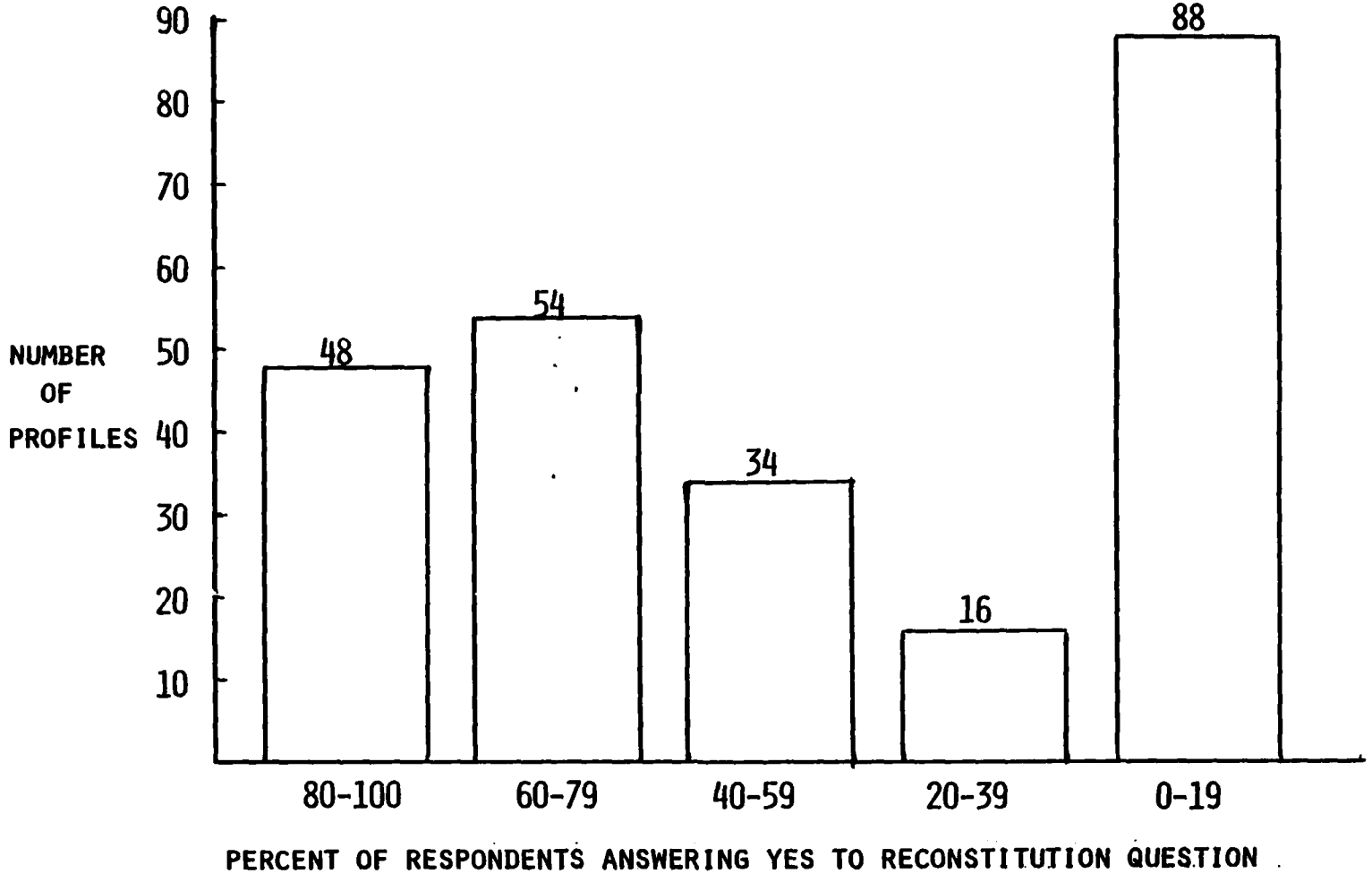


Figure 6-5. Number of profiles by response category.

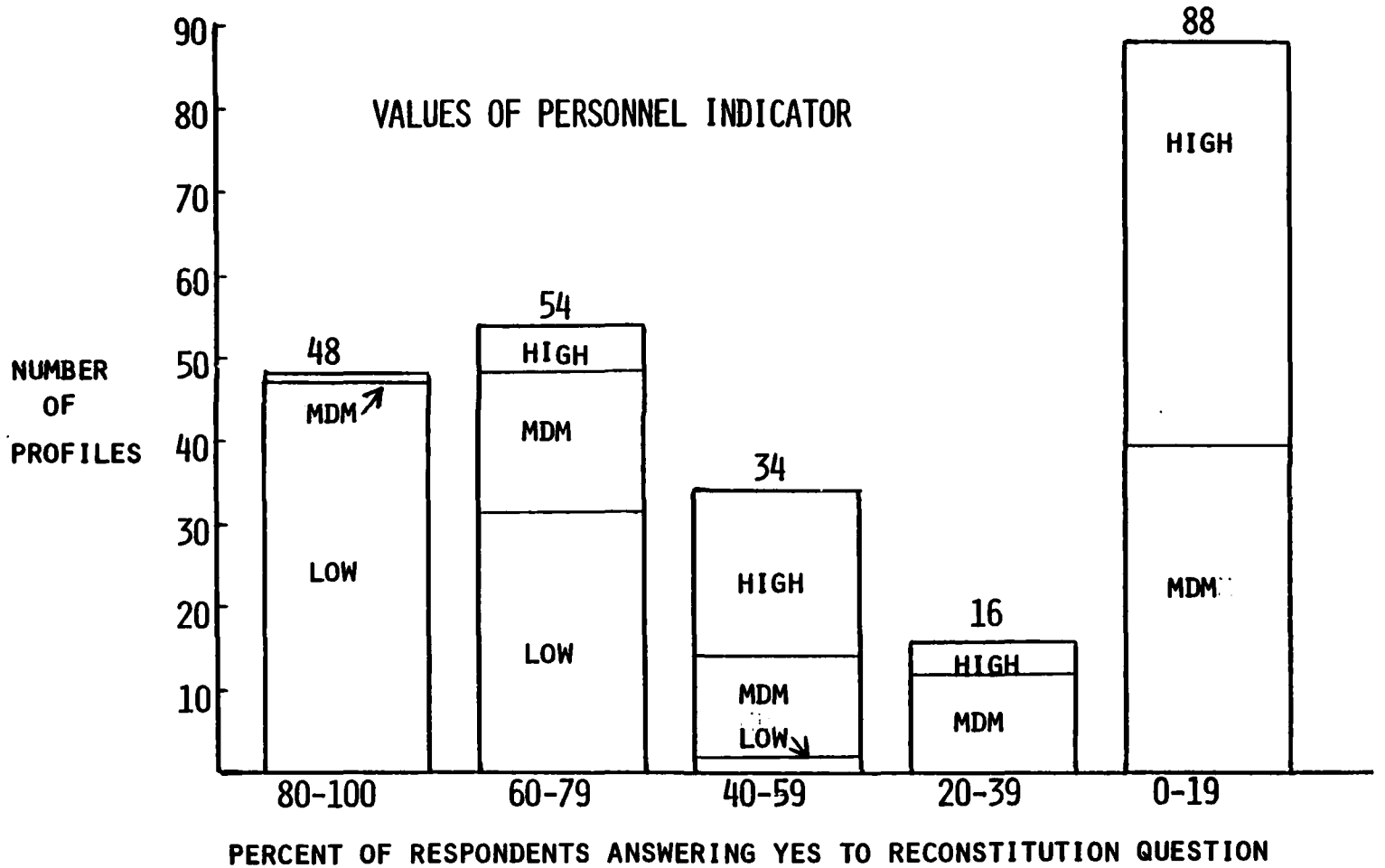


Figure 6-6. Values of personnel indicator by response category.

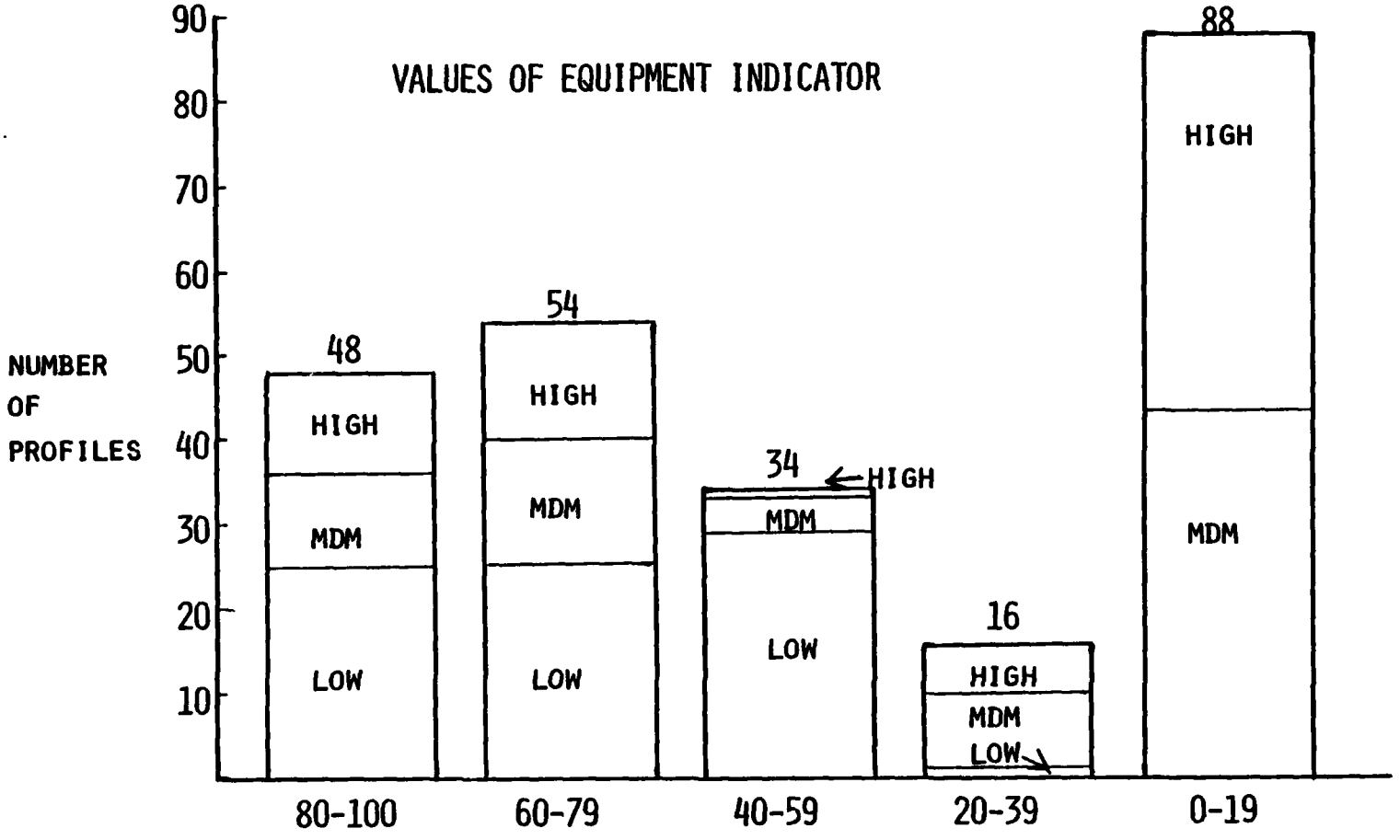


Figure 6-7. Values of equipment indicator by response category.

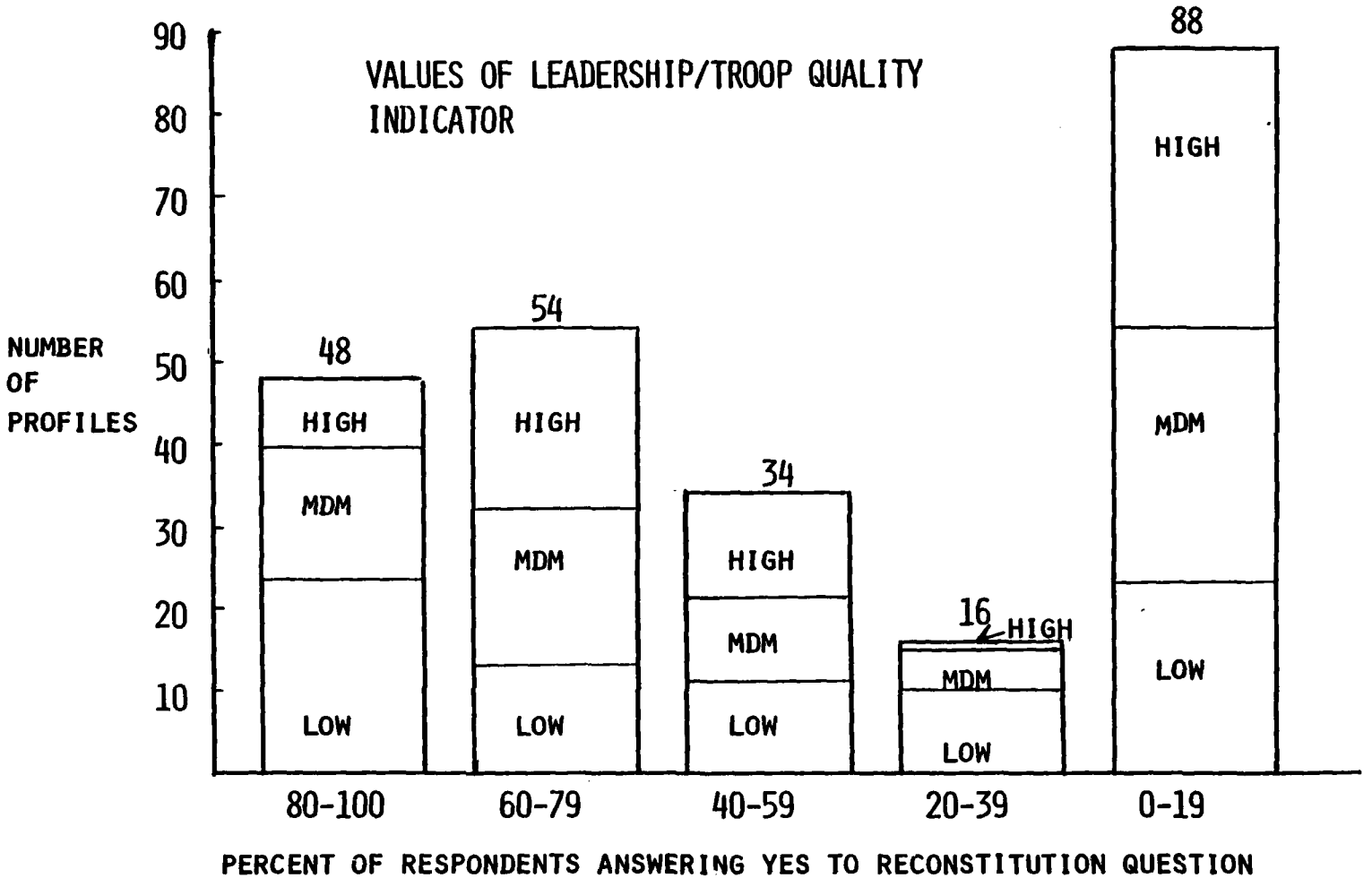


Figure 6-8. Values of leadership/troop quality indicator by response category.

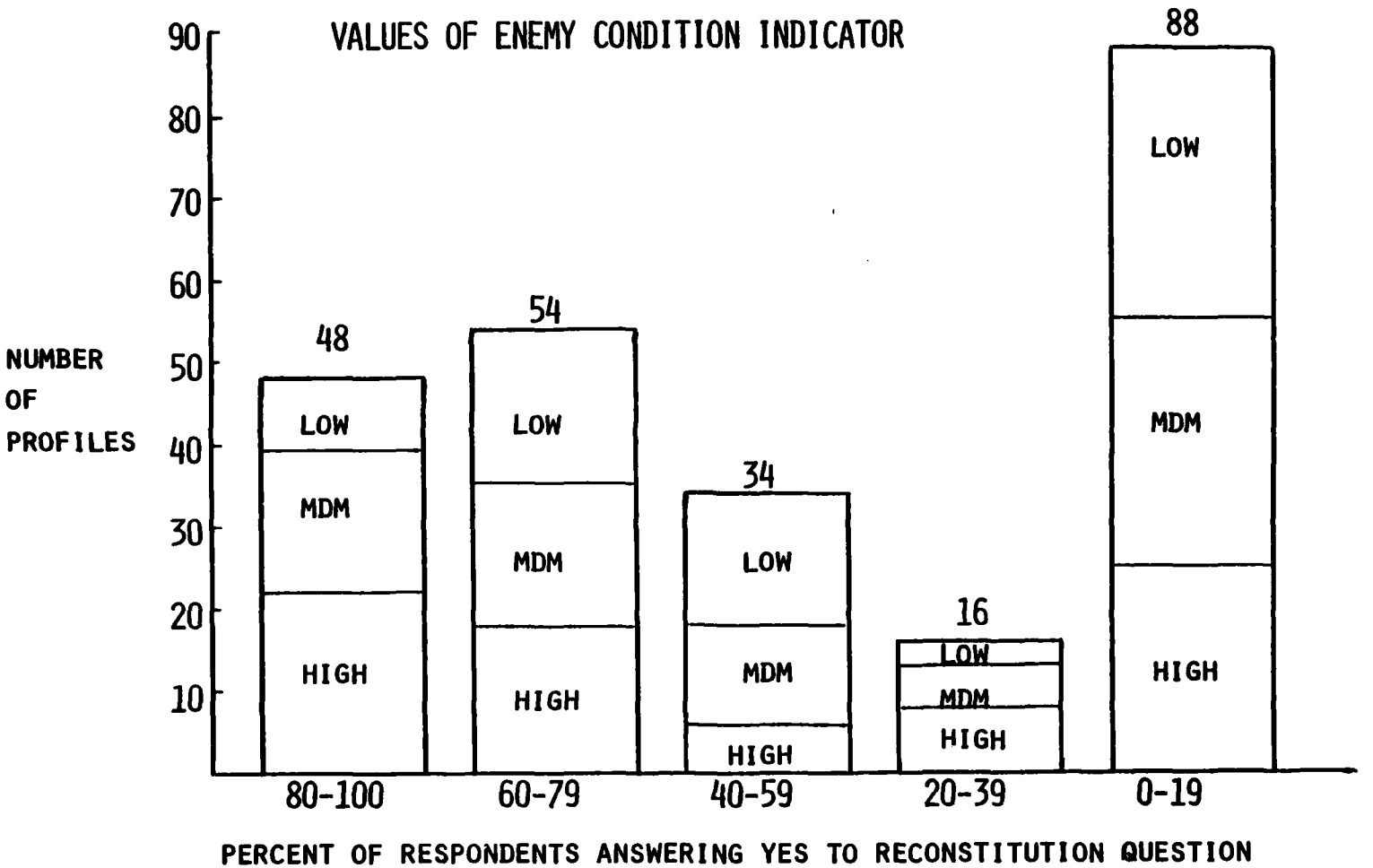


Figure 6-9. Values of enemy condition indicator by response category.

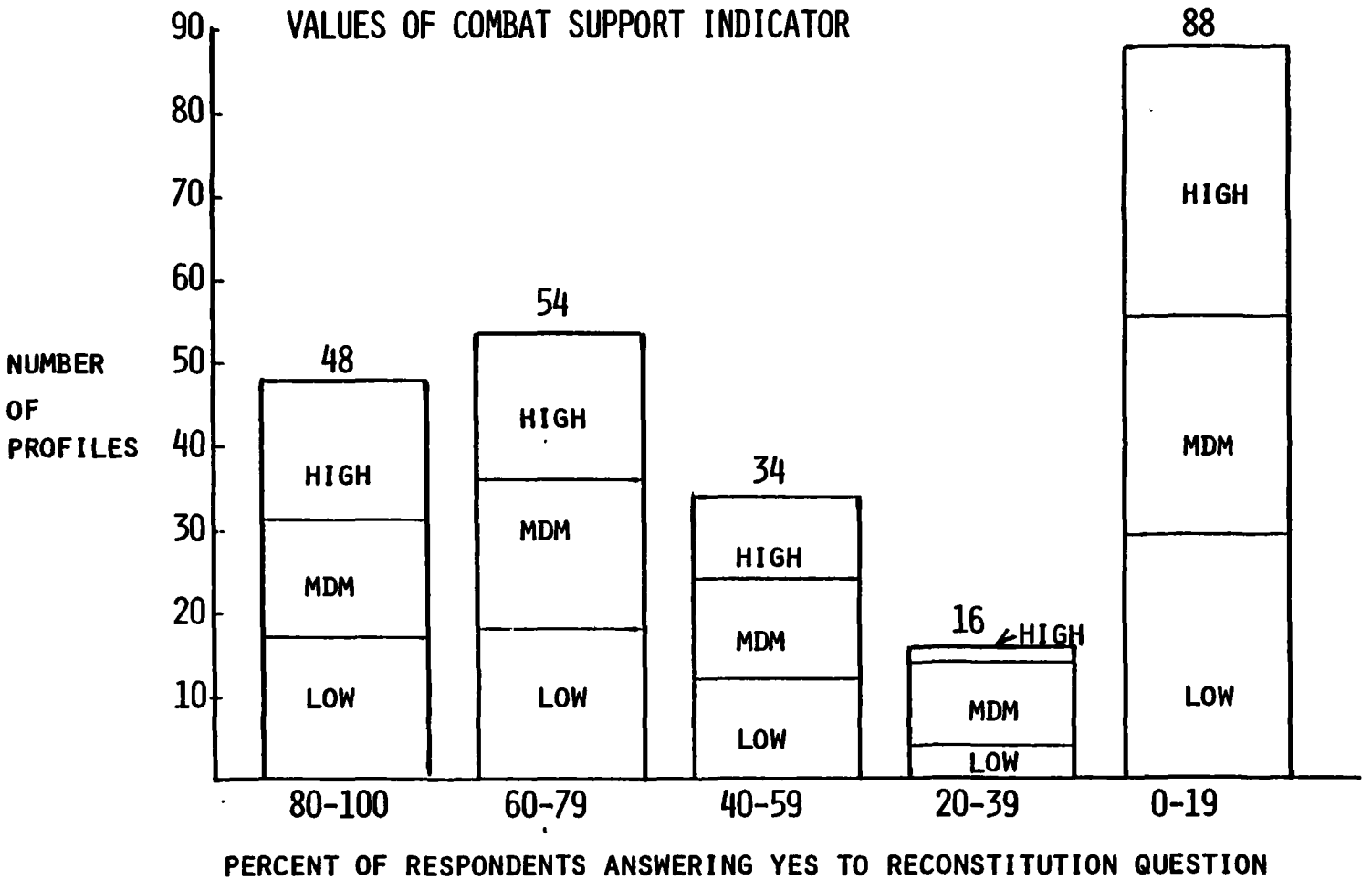


Figure 6-10. Values of combat support indicator by response category.

(b) At the other extreme, the 48 profiles judged by 80 percent or more of respondents to need reconstitution are shown in figure 6-6 to consist almost entirely of profiles having the personnel indicator at a low level. Over half of the 54 profiles in the next group also have a low personnel level. Figures 6-7 through 6-10 show that the other four indicators are at various levels for the profiles in these two groups.

(c) The middle ground in figure 6-5 is occupied by the 34 profiles judged to require reconstitution by 40 to 59 percent of the respondents. In other words, these profiles are those for which the respondents showed no clear preference on whether reconstitution is needed. These 34 profiles are shown by figure 6-6 to have the personnel indicator primarily at the high and medium levels. Figure 6-7 shows that the equipment indicator is primarily at the low level. Figures 6-8 through 6-10 show that the other indicators are at various levels for these 34 profiles.

(2) The relationships among the indicator levels were explored further in an attempt to highlight obvious trends. In figures 6-11 through 6-14 the 102 profiles for which over 60 percent of the respondents decided that reconstitution is needed are grouped together in the bar at the left. On the right are the 104 profiles for which over 60 percent decided that reconstitution is not needed. In the center are the 34 profiles for which no clear preference on the reconstitution question was shown. In figure 6-11 the values of the personnel and equipment indicators are shown together for the profiles in the three categories. Similarly, figures 6-12 through 6-14 show the personnel indicator values in combination with the leader/troop quality indicator, the enemy condition indicator, and the combat support indicator, respectively. Figure 6-11 shows that the profiles that most respondents decided did not need reconstitution are composed, with one exception, of personnel and equipment indicator combinations at high and medium levels. Those that most respondents felt needed reconstitution were composed of low personnel indicators combined with high, medium, or low equipment indicators or medium and high personnel indicators combined exclusively with low equipment. This combination of medium or high personnel with low equipment is dominant in the 34 profiles in the middle category. Figures 6-12, 6-13, and 6-14 show that the other three indicators are fairly evenly distributed in combination with the personnel indicator in all categories.

c. Summary. This exploratory analysis provided an initial indication that personnel and equipment considerations dominated the respondents' decisions on whether reconstitution was needed in the profile situations. More sophisticated statistical techniques were needed to confirm this finding, to determine the strength of the dominance, and to identify the relationship of all five variables to the evaluation of combat effectiveness potential. These analyses are described in the following paragraphs.

6-6. PATH ANALYSIS. The original hypothesis underlying the data collection and analysis was that the respondents would tend to aggregate the five effectiveness indicators into an overall effectiveness rating and would reason from that rating to a decision on the need for reconstitution. This

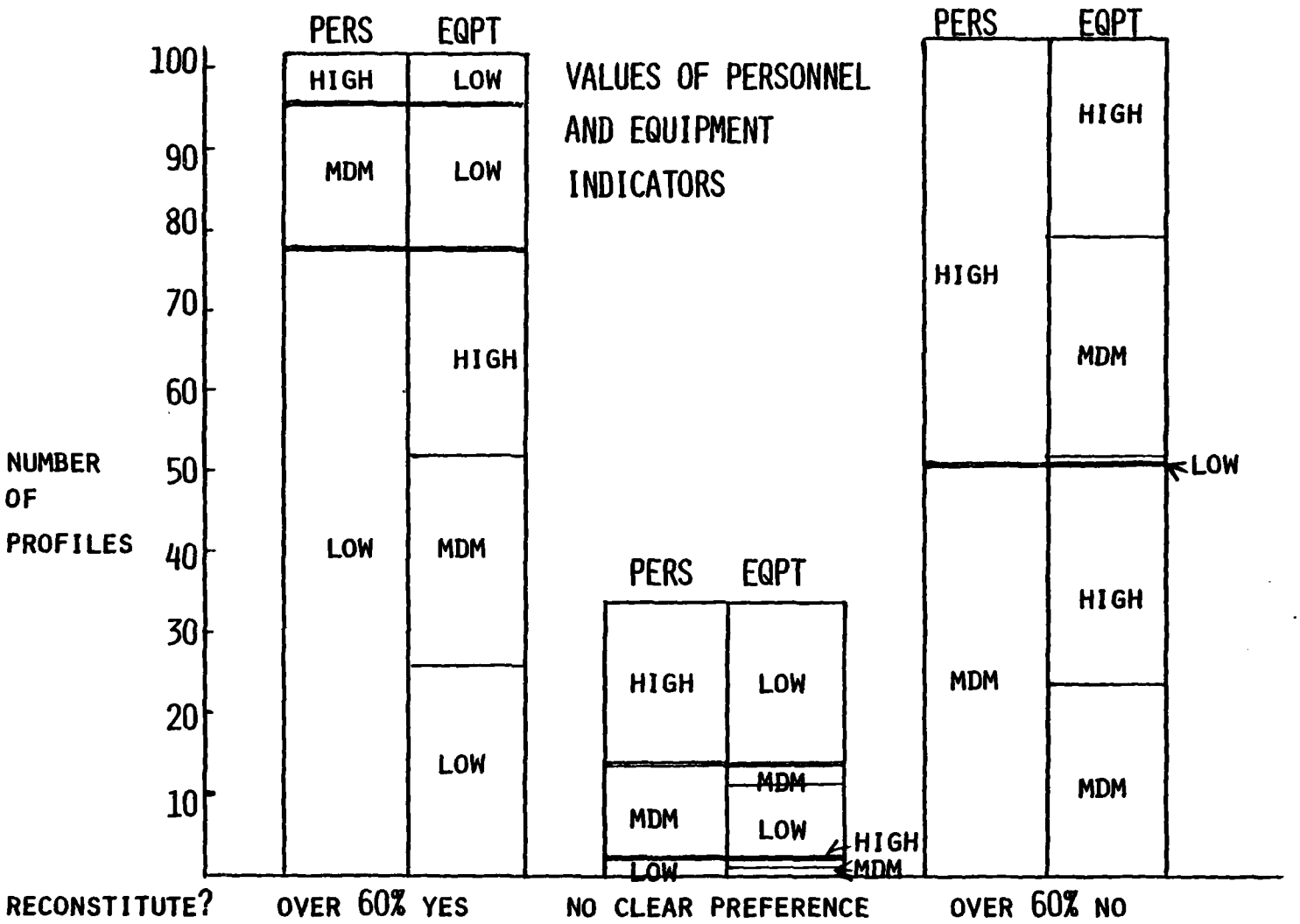


Figure 6-11. Values of personnel and equipment indicators by response category.

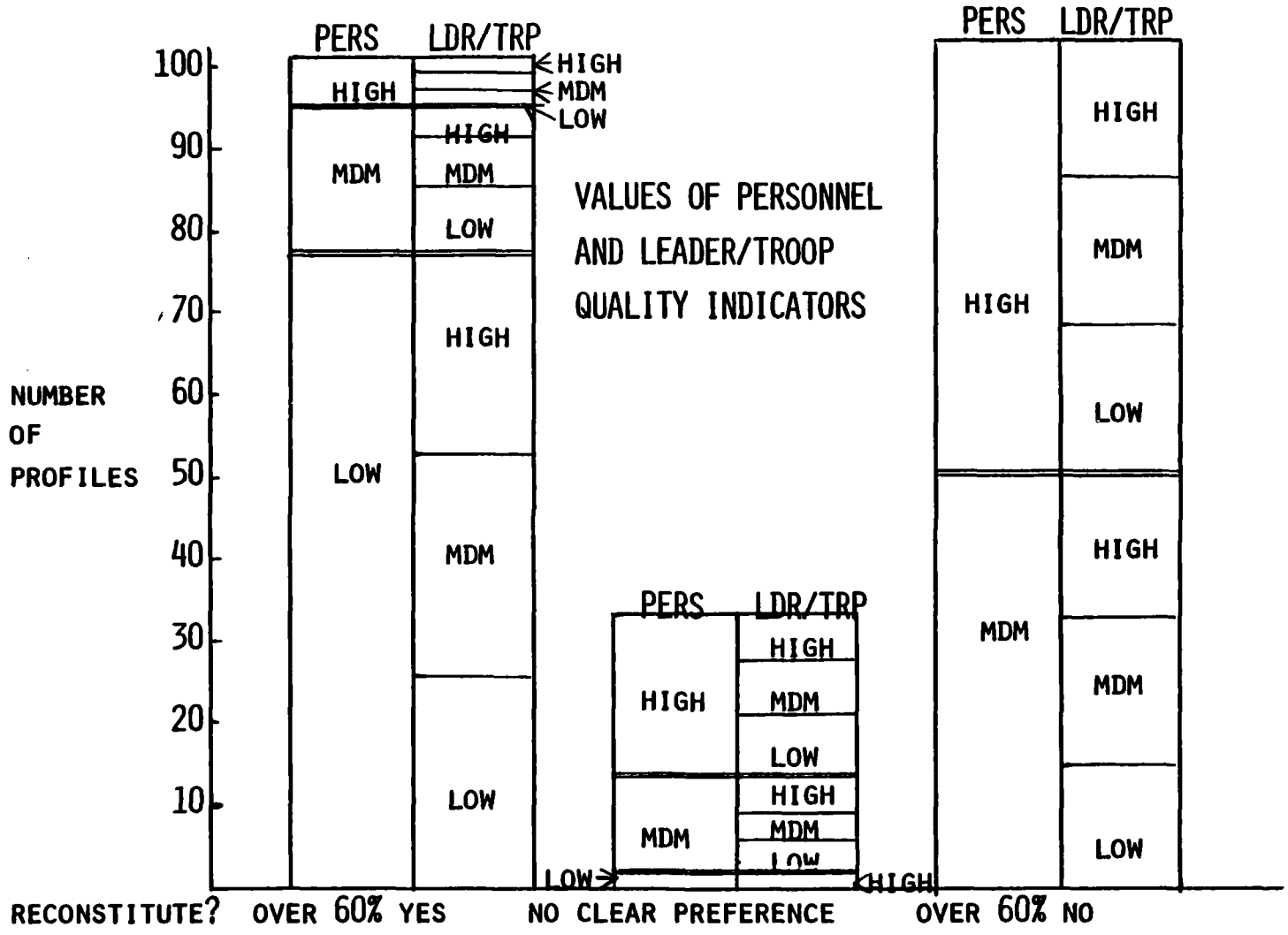


Figure 6-12. Values of personnel and leader/troop quality indicators by response category.

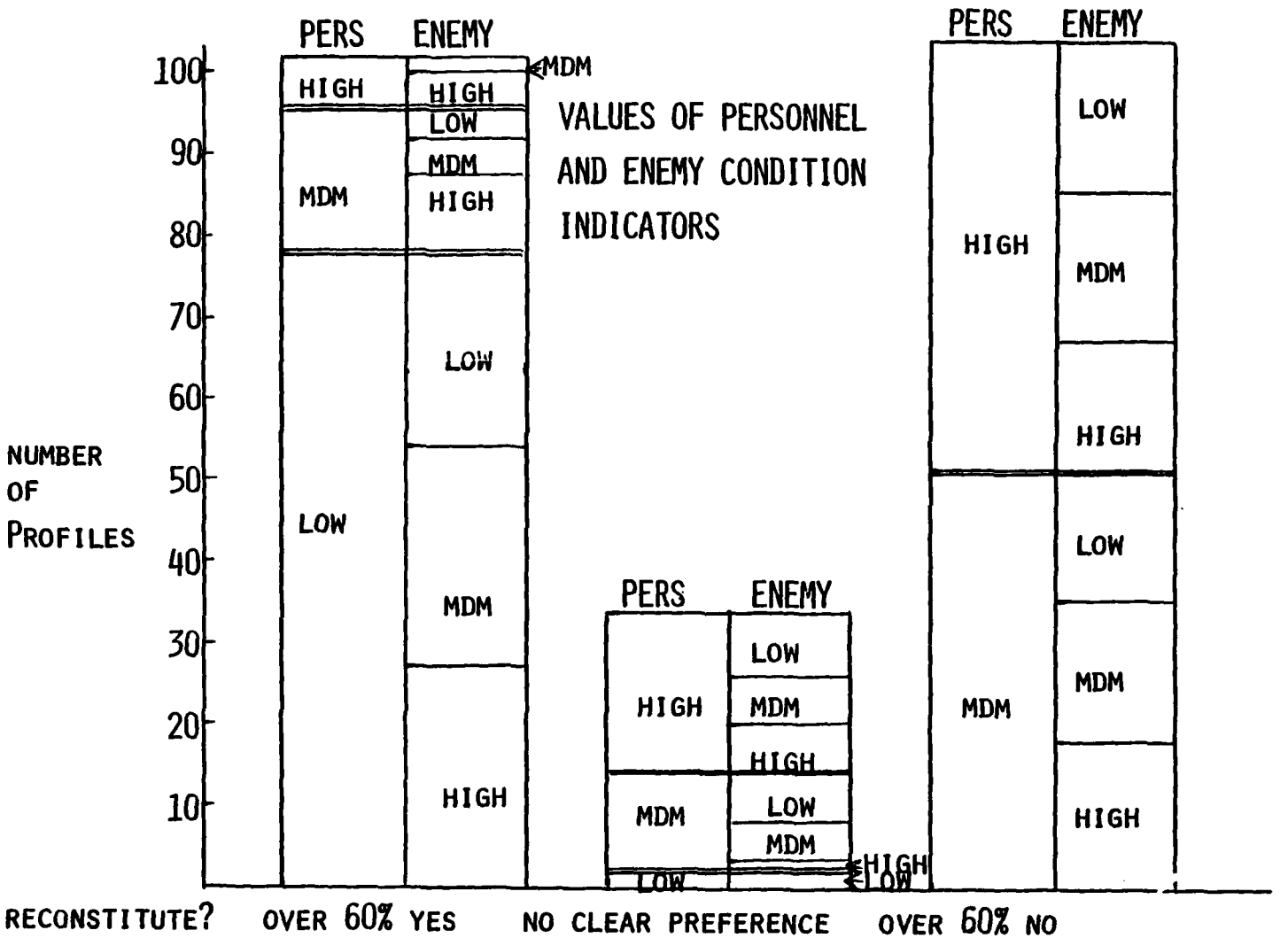


Figure 6-13. Values of personnel and enemy condition indicators by response category.

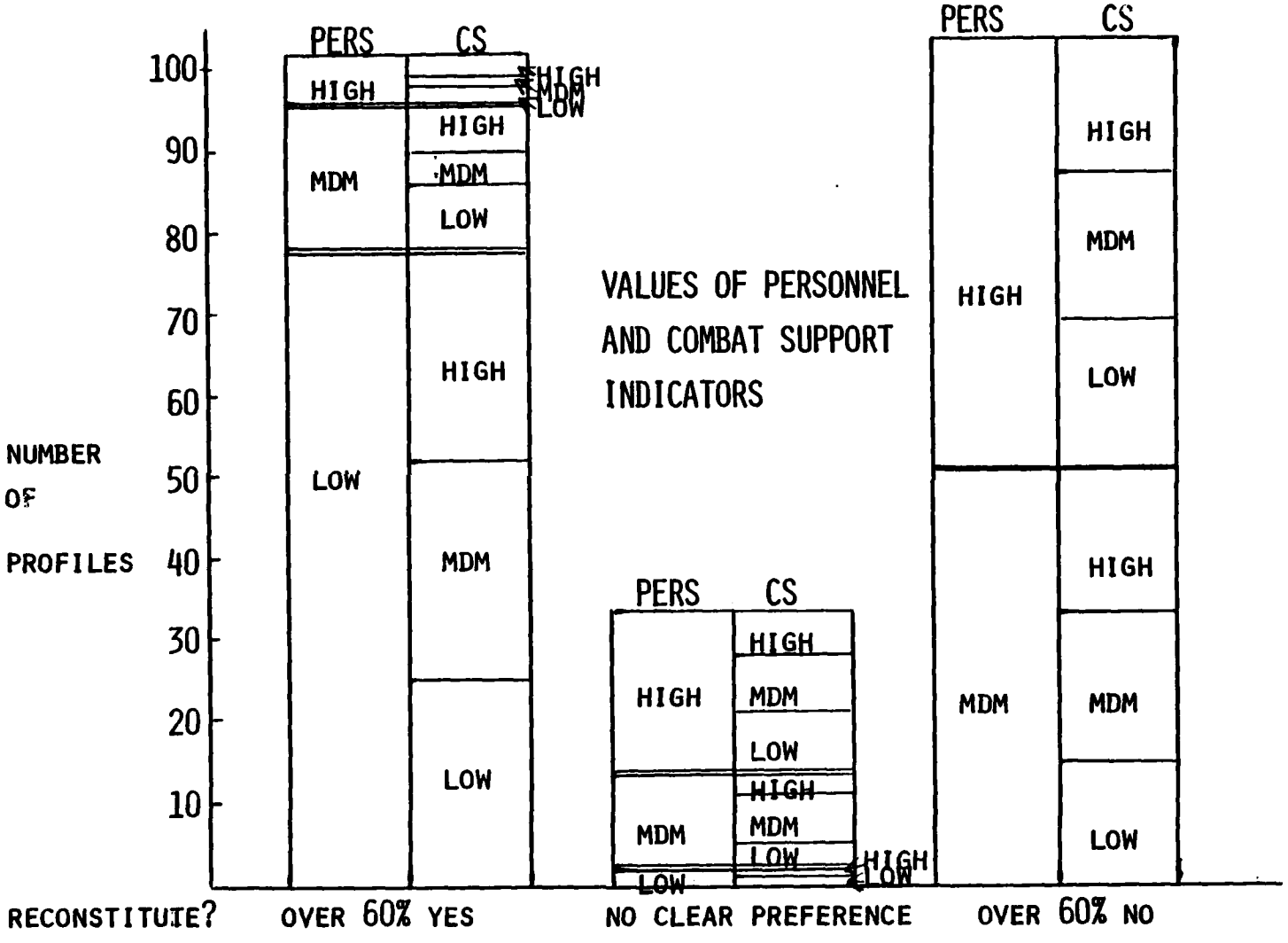


Figure 6-14. Values of personnel and combat support indicators by response category.

hypothesis is illustrated graphically in the path diagram at figure 6-15. Had the data conformed to this hypothesis, the indicators at various combinations of levels could have been mapped into the effectiveness ratings and then related to the need for reconstitution. However, the data did not support the hypothesis in that it became apparent that some of the indicators were exerting an overwhelming influence on the reconstitution question. A path analysis was conducted to identify the amount of influence of each of the indicators on the decision on whether reconstitution is needed.

a. Technique. Path analysis, sometimes referred to as causal modeling, is a technique commonly used in the social sciences to explore the relationship effects existing among a set of variables that can be sequenced into a logical order. This technique relies heavily on the analytical procedures of multiple regression.

(1) In a path analysis, a distinction is made between exogenous and endogenous variables. The variability of an exogenous variable is assumed to be invoked by causes outside the causal model; that is, the determination of an exogenous variable is not under inspection in the model (Kerlinger and Pedhazur, 1973, p 308). In the current study the five indicators of the combat situation are the exogenous variables. No attempt is made to explain the relationships among them nor how their different manifestations would occur in a natural situation. In fact, in the current study these variables are manipulated so that they occur independently of one another and thus exhibit no correlation with each other. Conversely, an endogenous variable is one whose variation is explained by exogenous or other endogenous variables in the model. The rating of unit effectiveness and the decision regarding reconstitution are the only two endogenous variables in the subject analysis.

(2) A path diagram for the reconstitution question with all possible paths is illustrated in figure 6-16. The P_{ij}'s represent path coefficients (discussed in subparagraph (4) below). In this figure the variables have been recoded using the following scheme:

X_1 corresponds to personnel status
X_2 corresponds to equipment status
X_3 corresponds to combat support status
X_4 corresponds to enemy status
X_5 corresponds to leadership/troop quality status
X_6 corresponds to the rating of unit effectiveness
X_7 corresponds to the reconstitution decision.

In addition variables E_A and E_B have been included to represent the effects of residual variables not explicitly contained in the model upon the variables X_6 and X_7, respectively.

(3) The causal flow of the model is provided by the arrows and, in this case, is unidirectional. This trait is often referred to as a recursive model and implies that at any given point in the model a variable cannot be both a cause and an effect of another variable.

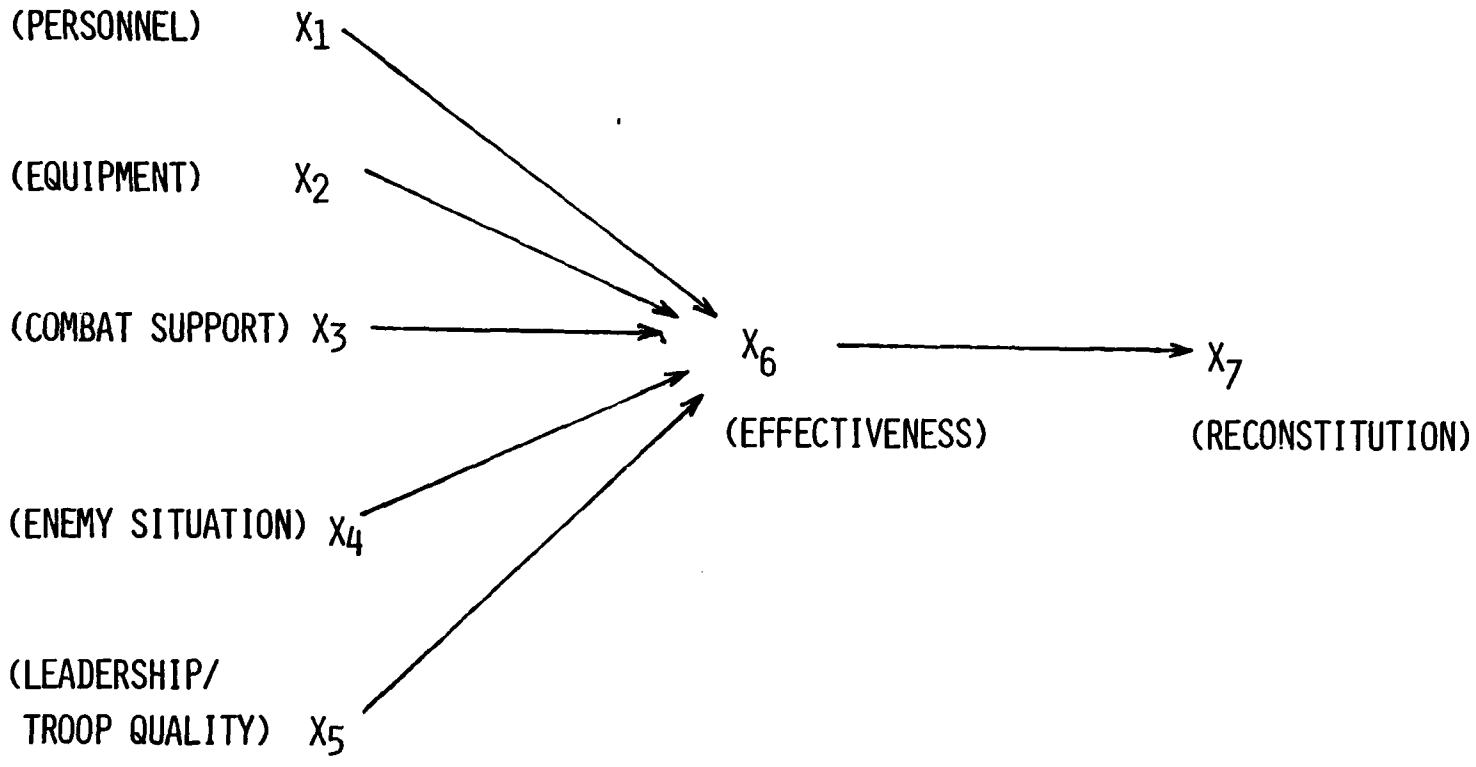


Figure 6-15. Original hypothesis for reaching decision on need for reconstitution.

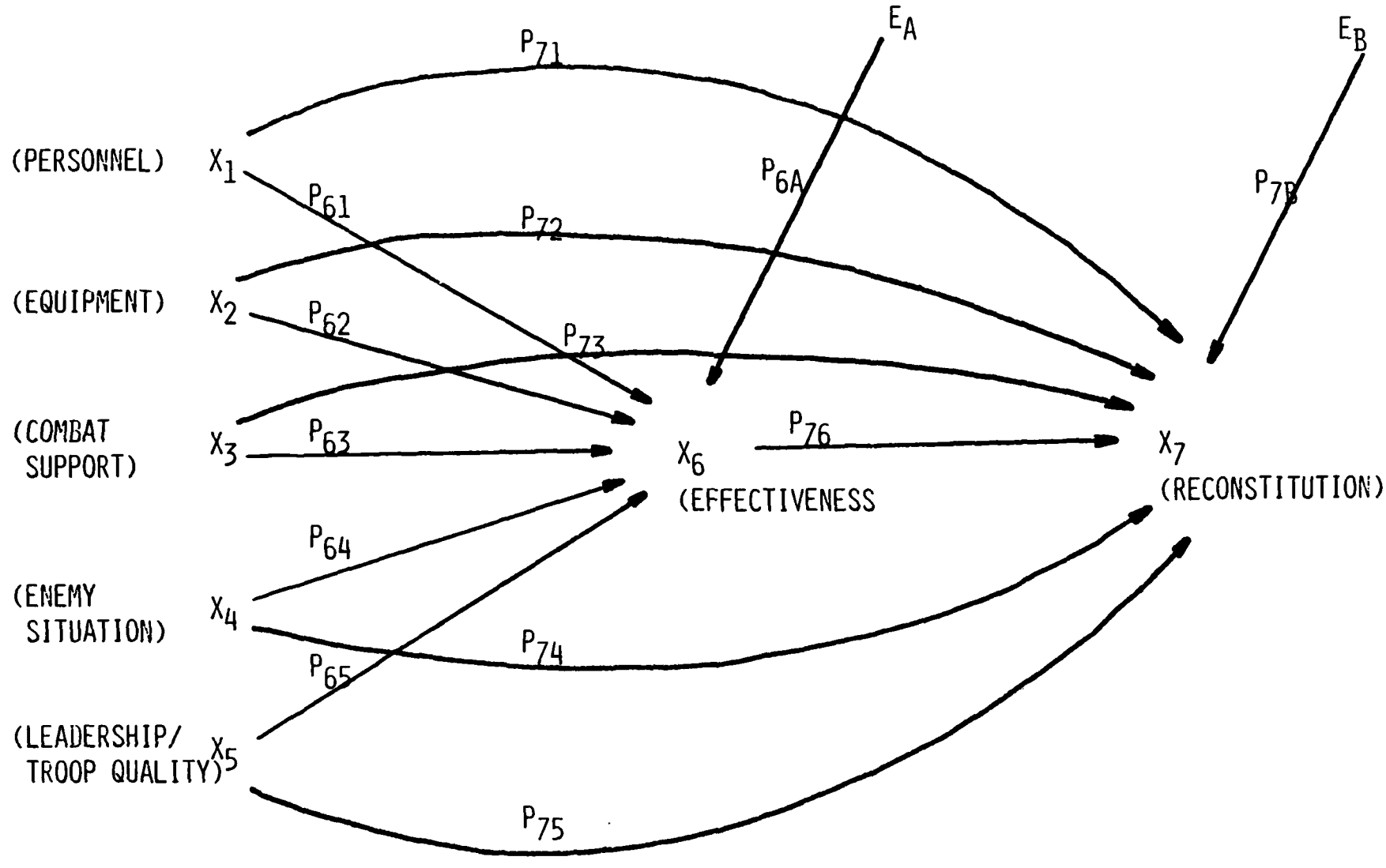


Figure 6-16. Path diagram with all possible paths included.

(4) Kerlinger and Pedhazur (1973, p 309) quote Sewall Wright's (the originator of path analysis) definition of a path coefficient as:

> The fraction of the standard deviation of the dependent variable (with appropriate sign) for which the designated factor is directly responsible, in the sense of the fraction which would be found if this factor varies to the same extent as in the observed data while all others (including the residual factors...) are constant.

In other words, a path coefficient reflects the direct effect of a variable taken as a cause on a variable taken as an effect. The alphabetic letter P with two subscripts is the symbol for a path coefficient, the first subscript indicating the effect and the second subscript indicating the cause. For example, in figure 6-16 P_{63} represents the direct effect on the rating of unit effectiveness (dependent variable) of the combat support status (independent variable). In this manner, an endogenous variable considered as dependent in one set of variables may also be conceived as an independent variable in relation to other variables. In the current study this relationship is demonstrated by the rating of unit effectiveness, which is considered as dependent on the five indicators of the combat situation but becomes an independent variable when the reconstitution decision is considered.

(5) An alternative way to formulate the same causal model is through a system of linear equations. Because the exogenous variables are assumed to be dependent on variables not included in the model they are represented by only a residual term. The endogenous variables of the model are represented by an equation consisting of the variables upon which they are assumed to be dependent as well as a term representing residual variance originating from variables outside the model. Traditionally, as well as for interpretation purposes, the variables are expressed in standard score (z-score) form; that is, the values of these variables have undergone a transformation in which the mean for all observations has been subtracted from each raw value and subsequently divided by the standard deviation of all observations. This procedure, in effect, equates the scales of measurement for the variables by yielding a mean of 0 and a standard deviation of 1 for each variable. Additionally, this eliminates the implicit weighting of the variables due to their differences in variance. The system of equations corresponding to the path diagram expressed in figure 6-16 is:

$$z_1 = e_1$$

$$z_2 = e_2$$

$$z_3 = e_3$$

$$z_4 = e_4$$

$$z_5 = e_5$$

$$z_6 = P_{61}z_1 + P_{62}z_2 + P_{63}z_3 + P_{64}z_4 + P_{65}z_5 + e_6$$

$$z_7 = P_{71}z_1 + P_{72}z_2 + P_{73}z_3 + P_{74}z_4 + P_{75}z_5 + P_{76}z_6 + e_7$$

where the variable subscripts correspond to those in the path diagrams.

(6) Once the system of equations is developed, the task is to estimate the P_{ij}'s corresponding to each path. Provided that certain assumptions are made regarding the lack of correlation among residuals, and among the residuals and explanatory variables, this becomes a standard problem of regression analysis. In other words, the P_{ij}'s actually represent standardized regression coefficients. For example, to estimate the direct effects P_{61}, P_{62}, P_{63}, P_{64}, and P_{65} in relation to the variable, X_6, an ordinary least-squares regression analysis is performed with X_6 as the dependent variable and X_1, X_2, X_3, X_4, and X_5 serving as independent variables. Similarly, to estimate P_{71}, P_{72}, P_{73}, P_{74}, P_{75}, and P_{76}, X_7 is treated as the dependent variable and X_6 is added to the list of independent variables. The standardized regression coefficients resulting from these two analyses are taken as path coefficients. In the subject study the standard regression computer program of the Statistical Package for the Social Sciences (SPSS) as described by Nie et al (1975) was used to generate the path coefficients. Path coefficients for the residual terms, E_A and E_B, are computed by taking the square root of one minus the squared multiple correlation coefficient for the regression analysis (i.e., the square root of the variance unaccounted for by the model).

(7) In using path analysis, as with most sophisticated statistical procedures, numerous assumptions regarding the structure of the data must be made. The path analysis assumptions can be categorized into four general areas--those relating to causal association, the general linear model, the scaling of responses, and the estimation of regression parameters.

(a) Causal association assumptions. To apply path analysis two basic assumptions must be made--the variables can be placed into a weak causal order and the model is closed. The first of these assumptions implies that logical sequencing of the variables can be provided where each variable may affect the subsequent or parallel variables of the model but subsequent variables cannot affect any of the preceding variables. The second assumption implies that no significant variable is left out of the model that is exerting a substantial effect on variables included in the model.

(b) General linear model assumptions. As can be inferred from the system of equations developed in part (5) of this paragraph, the structure of the relationships among variables is assumed to be linear and additive. Additionally, the independent variables are assumed to occur without error.

(c) Scaling asssumptions. An additional assumption underlying path analysis is that the measurements of variables must be performed using an interval scale. The calculation of product-moment correlations necessitates this requirement initially.

(d) Parameter estimation assumptions. To carry out the regression procedure and produce reliable estimates the following four standard asssumptions of regression analysis must be accepted.

1. The error term has a mean of zero.

2. The dependent variable has a constant variance across different values of the independent variable (homoscedasticity).

3. Pairs of error terms arising from omitted variables are uncorrelated.

4. Error term and independent variables are uncorrelated.

(8) One of the advantages of path analysis is that in addition to direct effects, indirect effects can be computed for compound paths. The indirect effect of a compound path is equal to the product of the direct effects composing it. For example, in figure 6-16 reconstitution can be affected by the compound path $X_1 \rightarrow X_6 \rightarrow X_7$. The indirect effect of this path is the product of P_{61} and P_{76} and amounts to the degree of change in X_6 brought about by X_1, which in turn is transmitted as a change in X_7.

(9) As a result of the preceding definitions and assumptions, the correlation between two variables can be decomposed into three components: direct effects, indirect effects, and noncausal covariation. This has important implications for the identification of potential models that represent a set of data as well as the testing of hypothesized models. In the first application path coefficients of approximately zero can be eliminated as being of little practical importance. This results in the deletion of paths and provides a potential theoretical model consistent with the data. A real danger of this procedure is that in complex situations several logical compositions of the variables may result in potential models that are consistent with the data. On the other hand, a theoretical model may be hypothesized a priori and then tested for consistency against the data. This is the preferrable situation. The present analysis makes use of both these modes. The model initially hypothesized and illustrated in figure 6-15 is rejected on the basis of the actual data, and a reduced model is derived by eliminating paths from figure 6-16 based on the empirical data.

(10) For a more complete and detailed explanation of path analysis the reader should consult Kerlinger and Pedhazur (1973, 305-331), Asher (1976), or Nie et al (1975, 383-397).

b. Results.

(1) The results of applying the path analysis procedure are illustrated in figure 6-17 and listed in table 6-4. Figure 6-17 indicates the magnitude of the path coefficients along the arrows that identify the proposed

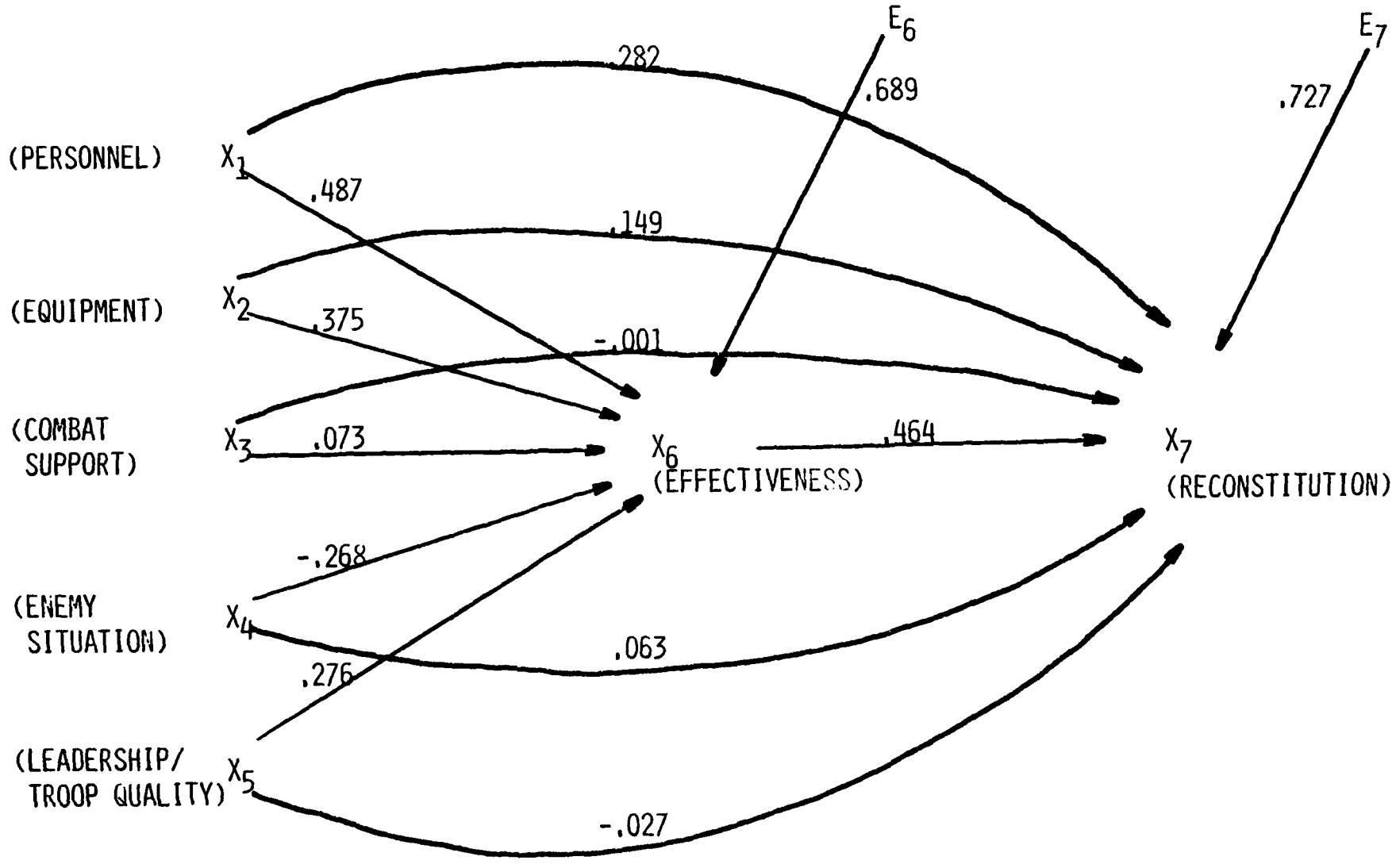


Figure 6-17. Path coefficients for the reconstitution decision with all paths included.

Table 6-4. Direct and indirect effects of the five exogenous variables on the reconstitution decision.

Variable	Direct	Indirect	Total
Personnel (X1)	.282	.226	.508
Equipment (X2)	.149	.174	.329
Combat Support (X3)	-.001	.034	.033
Enemy Situation (X4)	.063	-.124	-.061
Leadership/Troop Quality (X5)	-.027	.128	.101

causal relationships. The negative relationships exhibited between the enemy situation and overall effectiveness results from the inverse coding of these variables (i.e., a high enemy threat results in a lower overall effectiveness and vice versa). Additionally, the squares of the path coefficients relating the residual components, E_6 and E_7, to the endogenous variables, X_6 and X_7, indicate that 47 percent and 53 percent of the variance associated with these variables was left unaccounted for by the model. Table 6-4 discloses that both personnel status and equipment status contribute direct effects to the decision to reconstitute whereas combat support status, the enemy situation, and leadership/troop quality contribute relatively little. All exogenous variables except the combat support status combine with overall effectiveness to produce modest indirect effects in this table. In terms of total effect, personnel status and equipment status dominate the other three variables.

(2) It should be noted that at least one assumption of path analysis was violated (and perhaps another) in the development of these results. However, in neither instance is the effect thought to be major.

(a) Ordinal level data were used in the regression calculations rather than interval level data; that is, the independent variables were structured as high, medium, and low rather than on a continuous interval scale. To some extent the same shortcoming is true of the rating of overall effectiveness although this rating consisted of nine categories, which represented a scale from 0 to 100 percent. As discussed by Asher (1976, 64-67) and Boyle (1970) the use of ordinal data in place of interval data is rarely a major concern. This is especially true in this instance where levels of the ordinal variables appear somewhat equally spaced. It is the large distortions in ordinal scales that can severely alter results.

(b) Based upon the results of a sample of regressions for individual respondents, it is likely that a set of variables reflecting personal command styles of individuals is needed to augment the model and achieve complete closure. Unfortunately, the collection of these data would require complex psychological testing of respondents beyond the scope of this analysis. The precise effects of this omission cannot be determined; the trends identified among the modeled variables are presumed to be correct although their magnitudes might be affected somewhat by the omission.

(c) No other explicit or implicit violations of the assumptions for path analysis are known; however, no elaborate or extensive analyses of the assumptions have been performed.

(3) The results also must be interpreted in terms of the samples utilized to gather the data. The results depend not only upon the representativeness of the sample of respondents used but also upon the representativeness of the sample of combat profiles. This study is based on the premise that the combat profiles are a sample of all combat situations. For any reduced set of combat situations the relationships among the variables might be severely altered.

c. Discussion.

(1) Originally hypothesized model. Because the intuitively appealing model presented in figure 6-15 does not match the empirically collected data, it is rejected as too simplistic. Major discrepancies are evidenced by the prominent direct effects of personnel and equipment status on the reconstitution decision as well as by the small direct effect of combat support status exhibited on overall effectiveness.

(2) Reduced model. Based on the elimination of near-zero path coefficients, a reduced model is derived from the full model illustrated in figure 6-17. This reduced model is illustrated in figure 6-18. Based on both the small direct and indirect effects of combat support status, as stated in table 6-4, this exogenous variable was completely eliminated in the reduced model. Additionally, the direct effects on reconstitution of the enemy situation and the leadership/troop quality have been eliminated in the reduced model. These path coefficients not only were relatively small, but also their numeric signs were reversed from what would be expected.

(3) Adequacy of reduced model. As mentioned in paragraph 6-6a(9), correlation coefficients arising from the data can be decomposed into direct effects, indirect effects, and noncausal covariation for a hypothesized model. If the model with all possible paths is hypothesized, all the correlation will be accounted for by the direct and indirect effects. For reduced causal models, the amount of noncausal covariation expresses the lack of consistency with the full causal model. Table 6-5 partitions the original correlations into the three classes as determined from the reduced causal model. It is apparent there is a moderate amount of noncausal covariation existing between overall effectiveness and the reconstitution decision. The size of this discrepancy indicates approximately one-fourth of the correlation existing between these two variables is not attributable to causation as defined by the reduced model. As indicated previously, individual differences in command style are hypothesized to account for this noncausal covariation. In other words, it is hypothesized that a set of interpersonal variables is also influencing the overall effectiveness ratings and reconstitution decisions and therefore should be included in the model. The only information gathered about the respondents was related to their military experience rather than to their psychological makeup. Attempts to include military experience (e.g., highest staff position held, command time, branch, duration of combat experience) as interpersonal variables were unsuccessful. Thus, it is postulated that a set of variables relating to individual psychological attributes as manifested in personal command styles is needed to augment the model.

(4) Magnitude of interpersonal differences. In an attempt to identify the magnitude of these interpersonal differences, the rating of overall effectiveness was regressed on the five independent variables for a sample of individual respondents (those responding to Form A). The results of this effort indicated that on the average approximately 75 percent of the variance in the overall effectiveness ratings can be accounted for by the five independent variables. Recalling that approximately 50 percent of the

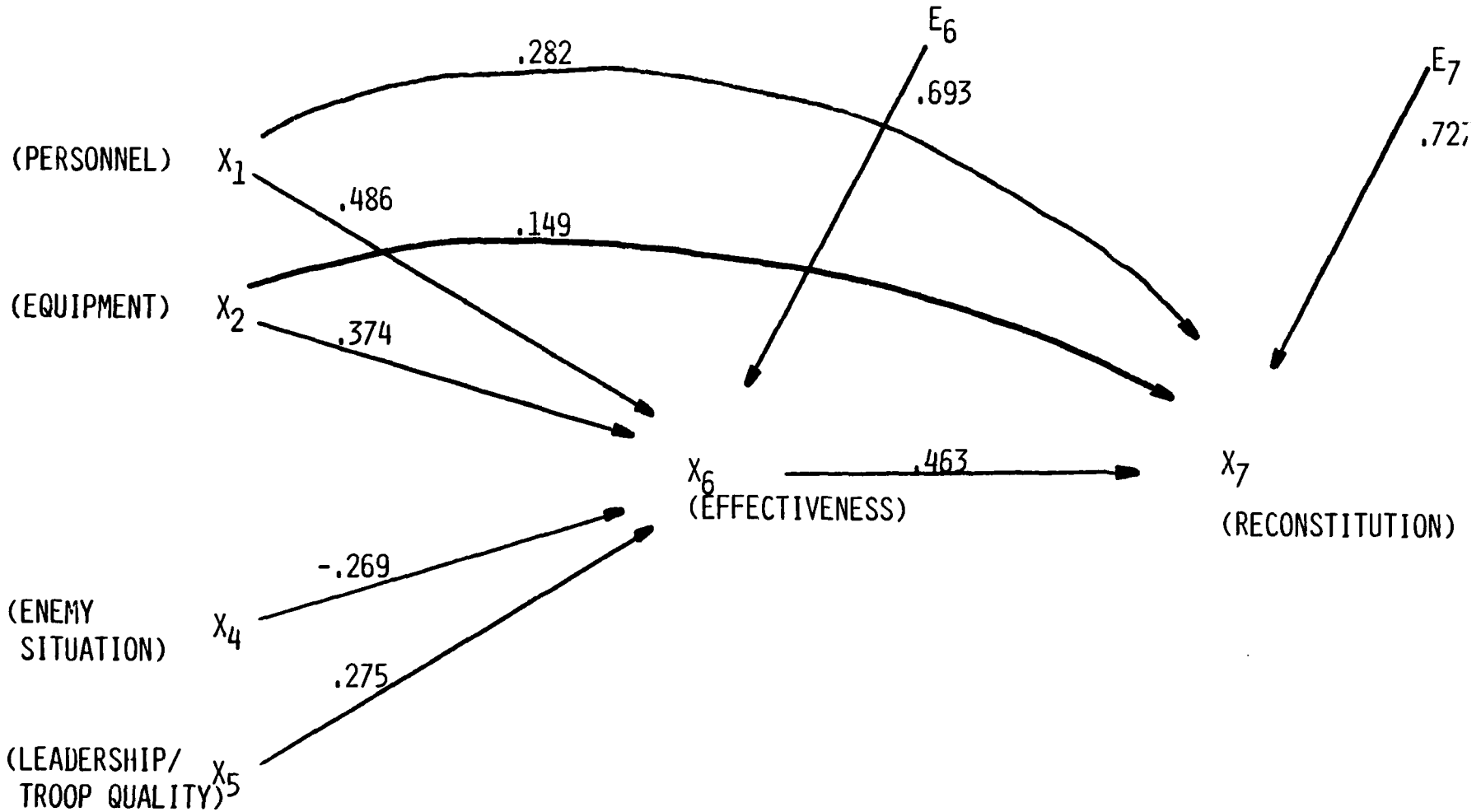


Figure 6-18. Reduced causal model for the reconstitution decision.

Table 6-5. Decomposition of the effects from path analysis using reduced model.

	Reduced Model					R^2	
	Zero Order Correlation	Direct Effect	Indirect Effect	Total Causal Effect	Noncausal Covariation	Full Model	Reduced Model
Effects on Overall Effectiveness						.525	.520
of Personnel	.479	.487	-	.487	-.008		
of Equipment	.365	.375	-	.375	-.010		
of Leader/Troop Quality	.264	.276	-	.276	-.012		
of Enemy Situation	-.290	-.268	-	-.268	-.022		
Effects on Reconstitution						.472	.472
of Personnal	.501	.282	.225	.507	-.006		
of Equipment	.312	.149	.174	.323	-.011		
of Leader/Troop Quality	.086	-	.128	.128	-.042		
of Enemy Situation	-.079	-	-.124	-.124	.045		
of Overall Effectiveness	.628	.463	-	.463	.165		

variance was accounted for by the model, this implies the difference, about 25 percent of the variance, is attributable to the interpersonal differences. The remaining 25 percent of the total variance remains unexplained.

d. Summary. The results presented and discussed above lead to findings for this phase of the analysis, summarized as follows:

(1) Approximately 50 percent of the variance occurring in the reconstitution decision and in the evaluations of overall effectiveness can be explained by the causal model as presented.

(2) Personnel and equipment status influence the decision to reconstitute both directly and indirectly.

(3) The enemy situation and leadership/troop quality influence the decision to reconstitute only indirectly.

(4) Combat support status does not influence the decision to reconstitute either directly or indirectly.

(5) Approximately 25 percent of the variance occurring in the overall effectiveness ratings can be attributed to interpersonal differences.

6-7. CLUSTER ANALYSIS. Based upon the large interpersonal differences described in the preceding paragraph, an attempt was made to group the respondents into different sets responding similarly to the reconstitution question. Statistically, such a procedure is termed a cluster analysis on cases.

a. Techniques.

(1) The general procedure for clustering cases is to identify the two cases with the shortest distance between their characteristics. In this analysis, the cases are the individual respondents and the characteristics are the responses to the reconstitution question (1 = Yes; 2 = No). The closest two cases based on total distance are amalgamated and treated as a single case and then, in turn, clustered with others. This procedure is repeated until all cases and clusters are amalgamated into one cluster.

(2) In this specific application the BMDP2M program of the Biomedical Computer Programs (BMDP) package (Dixon, 1975) was used. The Φ^2 option of this program was used to compute the distances between cases. Because the combat profiles were different on each form of the questionnaire, four cluster analyses actually were performed.

b. Results. Examination of the computerized results revealed that partitioning the respondents on each form into two groups was most compatible with the data as well as practical.

c. Discussion.

(1) Based upon the identified clusters, path analyses were performed for each questionnaire form. The results of these analyses demonstrated that the two-cluster concept provided similar results across the different questionnaire forms. The results displayed in figures 6-19 and 6-20 provide the average path coefficients for the reduced causal models, arbitrarily labeled A and B, respectively. An examination of the two models reveals that the B cluster's dominant focus was on the direct and indirect effects of personnel status; so much so that the direct effect of the equipment status could be omitted from the model. On the other hand, the cluster A model closely resembles the reduced model derived from the entire set of data as presented in paragraph 6-6. However, in both cluster models, the path coefficients of the residual terms are not enough smaller than those of the composite reduced model to indicate a great deal of practical significance in the partitioning as provided by cluster analysis. In other words, the clustering procedure actually accounted for less than one-fifth of the variance attributable to the interpersonal differences.

(2) A hypothesis was proposed that the two clusters arose from the sampling of infantry and armor officers as respondents. However, this hypothesis was not supported when the cluster compositions were examined. Approximately equal percentages of infantry and armor officers compose each cluster. Another hypothesis was that there might be a distinction by type of infantry service: mechanized versus "straight-leg." Unfortunately, this hypothesis cannot be tested since the distinction was not asked for in the original data-gathering process.

d. Summary. The findings of the cluster analysis are summarized as follows:

(1) Two groups of respondents were identified based on the similarity of their reconstitution decisions.

(a) One group (N=50) focuses on personnel mainly and overall effectiveness somewhat; this group omits the direct effect of equipment status on reconstitution.

(b) The other group (N=68) focuses on a more balanced approach consisting of personnel status, equipment status, and overall effectiveness.

(2) The statistical partitioning into groups did not account for a major portion of the variance attributable to interpersonal differences.

(3) Group membership did not appear to be a function of Army combat branch.

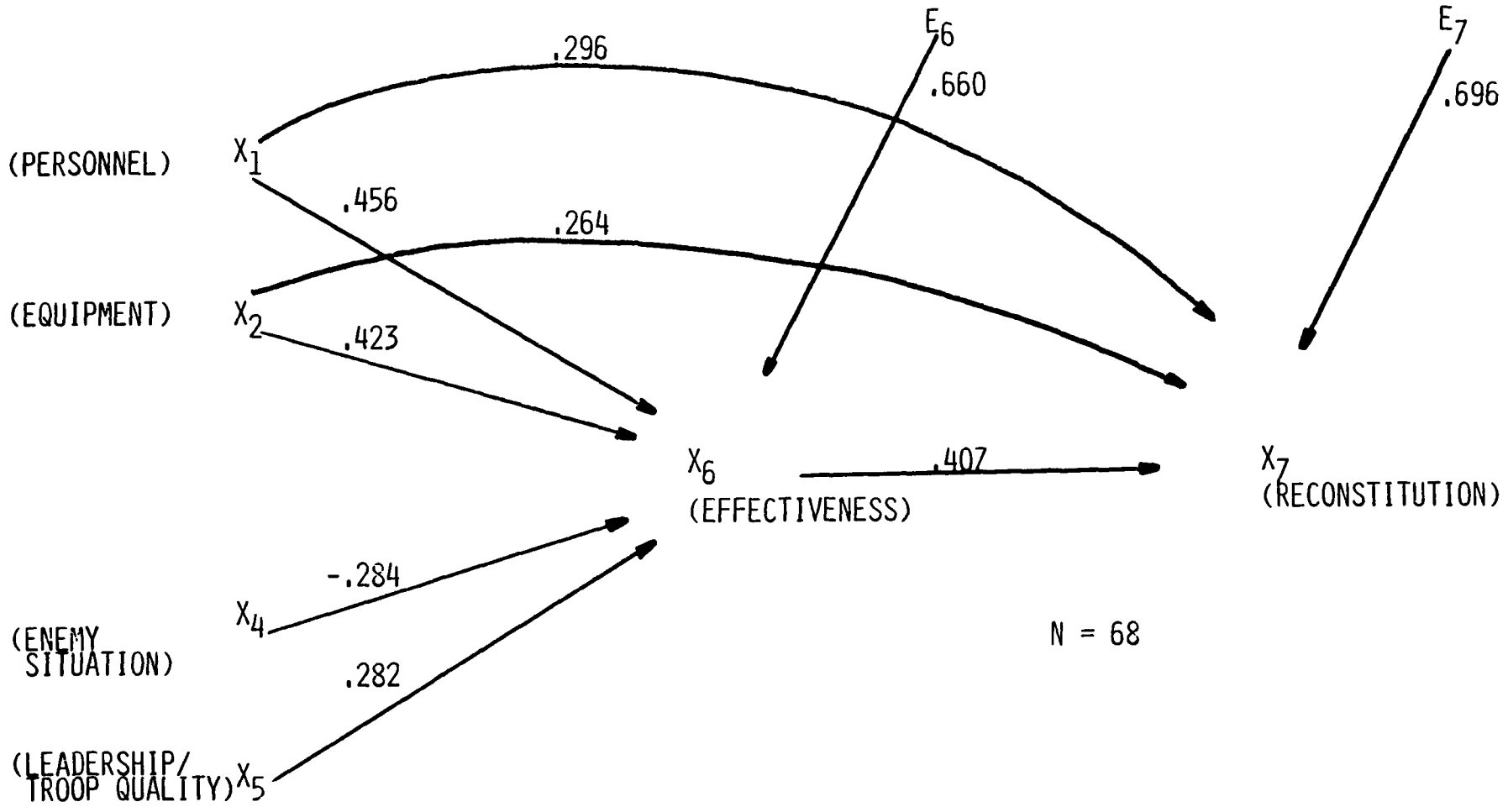


Figure 6-19. Reduced causal model and average path coefficients for cluster type A.

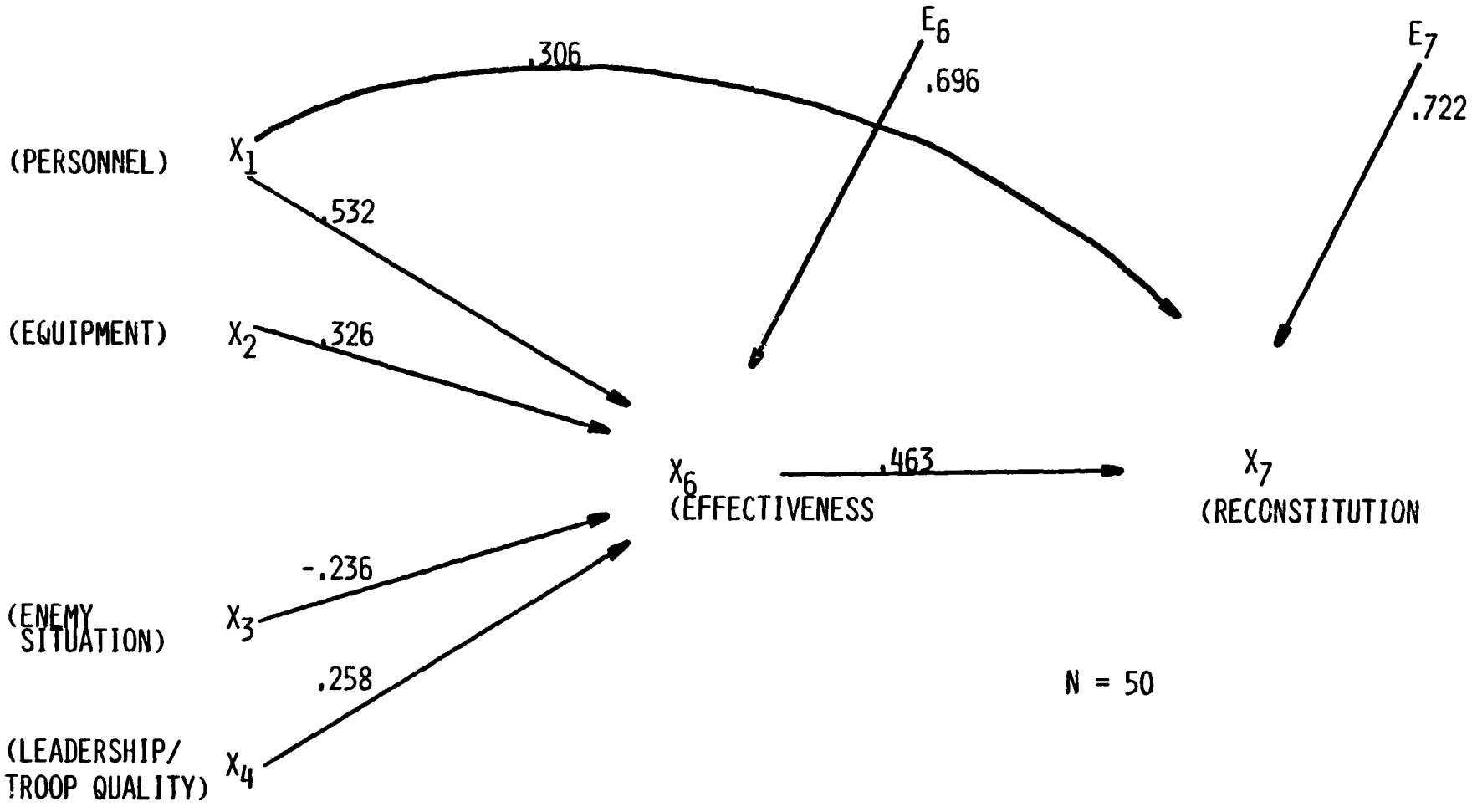


Figure 6-20. Reduced causal model and average path coefficients for cluster type B.

CHAPTER 7

SUMMARY AND CONCLUSIONS

7-1. SUMMARY.

a. The original hypothesis underlying this effort was that commanders who must decide when to reconstitute their units would approach the decision through an evaluation of unit combat effectiveness potential. By considering key attributes of the unit and the situation the commander would arrive at an assessment of the capability of the unit to continue performing its mission. Then, on the basis of his assessment, he would reach a decision on the need for reconstitution actions for the unit. This hypothesis is implicit in most studies of the reconstitution problem.

b. Under this hypothesis the thrust of this analysis was to identify key attributes, or indicators, of unit combat effectiveness and to present these indicators at varying levels to commanders to assess the resulting situations. It was expected that the commanders would develop weighting schemes or decision strategies leading them to assess the value of each indicator in the context of the total situation described by the set of indicators. Analysis of the commanders' judgments would then reveal the levels of each indicator, singly and as a set, that the commanders associated with various levels of combat effectiveness. The final step in the analysis would then relate the levels of combat effectiveness to the need for reconstitution.

c. The data base of military judgment gathered in this experiment did not support this hypothesis. In spite of written comments in which the officer respondents emphasized the importance of leadership and troop quality and enemy capabilities, the officers apparently tended not to be influenced by these indicators in reaching a decision on whether a unit in a described situation needed to be reconstituted. The original hypothesis was abandoned, and the data were then analyzed by path analysis techniques to determine which indicators exerted the most influence on the reconstitution decision directly and also indirectly through the evaluation of combat effectiveness. The data indicated that the officers tended to focus nearly exclusively on the status of personnel and materiel resources in reaching a decision on need for reconstitution. They considered other indicators and developed an evaluation of combat effectiveness related to need for reconstitution only when the status of personnel and materiel resources was so ambiguous that no clear reconstitution decision based on these factors alone seemed supportable.

7-2. ESSENTIAL ELEMENTS OF ANALYSIS (EEA). The study allowed the following answers to be developed for the EEA.

a. EEA 1. What unit and situational attributes are critical to the ability of a manuever battalion to continue effective combat performance? As described in chapter 3, the five key indicators of combat effectiveness potential defined for this experiment were as follows:

- Status of personnel and the command structure.
- Status of major weapons systems, equipment, and supplies and the capability of the combat service support system.
- Availability of combat support.
- The commander's perception of his enemy's capabilities and intentions.
- Quality of leaders and troops as manifested in such attributes as experience, morale, training, and group cohesion.

Eight-three percent of the officers participating in the exercise agreed that, in general, these indicators are appropriate for determining combat effectiveness potential in a combat situation.

b. EEA 2. What relative values of these attributes, in what combinations, indicate that a maneuver battalion can (cannot) continue to perform effectively? The analysis allowed several insights to be developed for this EEA, primarily in terms of the importance of the indicators and secondarily in terms of individual differences in commanders and their decision processes.

(1) Primary conclusions. In this experiment, the condition of personnel and materiel resources was found to be most influential in determining when a unit needs to be reconstituted. These two indicators exhibited both a direct effect on the reconstitution decision and an indirect effect through the evaluation of overall effectiveness. The indicators for commander perception of enemy condition and for leadership and troop quality were found to contribute to the reconstitution determination only indirectly as they were considered by the respondents as components of overall effectiveness. The status of combat support was not found to be a contributing indicator to either the assessment of combat effectiveness potential or the decision on need for reconstitution.

(2) Secondary conclusions. Differences among individual officers were a significant factor in the results, with some officers discerning a need for reconstitution even when combat effectiveness was high and others, at the other extreme, deciding against reconstitution even with low combat effectiveness. Two groups of officers were also identified based on the similarities of their decisions on the need for reconstitution. One group focused primarily on personnel status as a determinant; the other group gave a more balanced consideration to personnel and materiel status and overall effectiveness. The two groups showed no other distinguishing characteristics; e.g., no disproportion between infantry and armor branches or between confidence in their evaluations.

c. EEA 3. What decision rules can be formulated for commander use in determining that a maneuver battalion must be reconstituted in order to remain combat effective? Based on the data analysis for this study, guidance for commanders can be developed related to status of unit personnel and materiel resources and overall combat effectiveness potential.

- When personnel strength is reduced to 40 or 50 percent, decisions are needed on reconstitution actions to allow the unit to perform its mission effectively.
- When availability of major equipment is reduced to 30 or 40 percent, decisions are needed on reconstitution actions to allow the unit to perform its mission effectively.
- When the commander perceives that his unit's potential for effective combat is less than 40 percent, based on his consideration of all important indicators, decisions are needed on reconstitution actions to allow the unit to perform its mission effectively.

d. EEA 4. What warning points can be developed to indicate to the commander that a maneuver battalion is approaching ineffectiveness and that a reconstitution decision will have to be made? Warning conditions are an extension of the guidance developed for EEA 3; i.e., severe loss of either personnel or materiel resources or a marginal combat effectiveness potential (less than about 60 percent).

7-3. OBSERVATIONS. In addition to the findings and conclusions reported above, several observations can be made with respect to the procedures used in the study and the results obtained.

a. The extreme difference among individual respondents was noted. Responses on the need for reconstitution ranged from 2 of 60 profile situations requiring reconstitution at one extreme to 54 of 60 at the other extreme. Individual personalities will always be revealed in different command styles; however, the establishment of doctrine for reconstitution operations should help to reduce this apparently wide difference among commanders and to standardize approaches to reconstitution decisions.

b. The perspective of this study was that of the battalion commander evaluating the condition of his unit and determining if reconstitution actions were needed to allow the unit to perform effectively in further combat. The problem from the perspective of the brigade or division commander is a larger one in that, in addition to determining need, he must reach a decision on how and where to reconstitute, considering the relative condition of all his units, the options available to him, and the tradeoffs in light of the tactical situation. The findings of this study, as they help to clarify the issues involved and the critical attrition levels from battalion commander perspective, may be useful to commanders of larger units in exploring reconstitution problems.

c. Analysis of the questionnaire data showed that the officer respondents almost totally ignored the availability or nonavailability of combat support in evaluating the described situations. The significance of this finding can only be speculated upon. Possibly the finding may indicate a lack of confidence on the part of maneuver unit commanders in timely and effective combat support. It may indicate a lack of appreciation of the role that combat support can play in support of battalion operations. On the other hand, the profiles did not extend to a consideration of the important part that combat support would have in allowing various reconstitution operations to be conducted. In this sense, the finding should not be interpreted as a blanket dismissal by the respondents of the worth of combat support in the context of the total tactical situation.

d. The respondents apparently were influenced very little by their knowledge of threat capabilities. This could be interpreted as a lack of confidence in intelligence estimates, or it could be that the respondents were not able to develop a good appreciation of enemy condition from the information presented. More likely, the finding simply indicates a tendency on the part of the commanders to try to assure that their units are in good condition to face whatever threat develops.

e. The lack of influence of the intangible indicator, which considered the quality of leaders and troops, was surprising. Written comments of the respondents indicated that this should be an important factor, and inability to consider such intangibles is often cited as a weakness of studies using quantitative analysis. Several tacks could be taken in interpreting this result. It might be asserted that superior leadership, training, morale, and motivation are often useful in explaining the combat victories of outnumbered forces but are not so often decisive factors in planning operations. Social scientists might speculate on the finding as a comment on officer expectations as to the nature of modern combat and the importance of troop morale. A likely explanation is that the finding reflects the inability of commanders to conceptualize or grapple with the effect of intangible factors in other than an actual combat situation. If this is true, then combat simulations and war games, which rely on manipulation of the tangible factors of combat, may be somewhat exonerated since even the human commanders appeared to emphasize quantifiable factors and were unable to assess the impact of intangibles in a simulated situation.

f. Apart from the reported findings and conclusions, a value of this study is in demonstrating the potential of the student officer population at the Command and General Staff College and other courses as a resource for studies and analysis conducted at the Combined Arms Center. Techniques similar to those of this study could be used to tap the expertise of the students for input to many types of problems. Such methods would cause minimal interference with the workload of individual students but could be of great benefit to the credibility and realism of combat and training development studies.

APPENDIX A

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APPENDIX A

REFERENCES

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APPENDIX B

QUESTIONNAIRE

DEPARTMENT OF THE ARMY
HEADQUARTERS
COMBINED ARMS CENTER AND FORT LEAVENWORTH
FORT LEAVENWORTH, KANSAS 66027

ATZL-CG

30 MAR 1981

SUBJECT: Criteria for Reconstitution of Forces

1. One of the projects that the Combined Arms Studies and Analysis Activity (CASAA) is conducting at my direction is the Criteria for Reconstitution of Forces study. The purpose of this study is to develop guidance for commanders on when reconstitution of units in combat is required.

2. The attached questionnaire is an important part of the reconstitution study. It is being given to a randomly selected group of Armor and Infantry officers in the CGSC class. Results of the questionnaire will form a data base of expert military judgment, which will, in turn, be used to develop guidelines and criteria for command decisions on reconstitution.

3. Completing the questionnaire should require less than 2 hours of your time. Read the instructions carefully and give the questions your thoughtful consideration. To avoid biasing results, you should refrain from discussing the questions with others. Please return the completed questionnaire within 4 days to the Class Director's Office.

4. I appreciate your cooperation on this project.

William R. Richardson

1 Incl
as

WILLIAM R. RICHARDSON
Lieutenant General, USA
Commanding

Criteria for Reconstitution of Forces
Questionnaire

1. GENERAL INSTRUCTIONS

1-1. BACKGROUND. Commander, Combined Arms Center has tasked the Combined Arms Studies and Analysis Activity (CASAA) to develop guidance for commanders on when reconstitution of units in combat is required. The project is entitled Criteria for Reconstitution of Forces.

1-2. APPROACH. The decision to reconstitute a unit requires judgments of the unit's combat effectiveness and its potential to engage in further combat. Thus, the approach to the reconstitution project includes collection of a data base of expert military judgment. This questionnaire is one of the vehicles being used to collect the required data base.

1-3. PROCEDURES. The questionnaire will ask you to assume the role of a battalion commander and to assess the capabilities of your battalion. The questionnaire package includes the following sections:

a. Definition of the Reconstitution Issue. This section defines the term 'reconstitution' as used in this analysis. It also presents a set of five factors, or indicators, that encompass the key attributes of the combat situation that you as the battalion commander must consider in your evaluation and decision process.

b. Scenario. This is a short scenario describing the general and special situations of a division performing a defensive mission in Europe. The scenario is oriented specifically to your battalion task force. To avoid overburdening you with material, the scenario omits extraneous detail and includes only information considered necessary for you to develop your judgments.

c. Profiles. You will then be presented with a number of combat profiles. Each profile consists of a description of the status of each of the five combat effectiveness indicators, in the context of the basic scenario. In other words, each profile represents a different possible outcome of the scenario situation, described in terms of the five indicators.

d. Questions. You will be asked to respond to two questions for each combat profile. The first concerns your assessment of the battalion's chances of successfully continuing its assigned mission given the situation described by the profile. The next question concerns your judgment on whether the unit needs to be reconstituted.

e. Debriefing. Following the profiles, the package concludes with a few questions about your military experience and your reactions to the questionnaire. Your name is not required.

1-4. CONCLUSION. This questionnaire is being used to assist in gathering data on the reconstitution question. Following analysis of the questionnaire data, a report will be published to document the study. The report will provide guidelines and criteria for commanders to use in making reconstitution decisions. The results may also be incorporated as decision rules into combat games and simulations. Your cooperation in this effort is most appreciated. Thank you for your time and your careful considerations.

2. DEFINITION OF THE RECONSTITUTION ISSUE

2-1. RECONSTITUTION. For purposes of this study, reconstitution is defined as "non-routine actions taken to restore attrited units to a desired level of combat effectiveness." This definition emphasizes that reconstitution involves more than the normal internal resupply and replacement actions and concentrates on units that have marginal or unknown levels of combat effectiveness. Typical types of reconstitution actions included in this definition might be unit replacement, reorganization, or redistribution. However, the questionnaire focuses on a unit's need for reconstitution rather than on how or when the reconstitution would occur. Thus, you are not asked to consider specific types of reconstitution actions.

2-2. INDICATORS OF COMBAT EFFECTIVENESS POTENTIAL. A key element in the reconstitution question is the determination of a unit's effectiveness. A commander reckons with many indicators when he assesses the potential of his maneuver units to engage effectively in further combat. These indicators may be either tangible or intangible; i.e., some can be measured or evaluated quantitatively, others can be assessed only in subjective terms. Many indicators are implicit in the scenario in the next section; however, a set of five explicit indicators has been identified as critical to your evaluation of the ability of the battalion task force to continue its assigned mission. These indicators are defined below. In the enclosed questionnaire, these five indicators are described and combined in various ways to form profiles. These profiles, presented in the context of the scenario, will be the basis for your assessments in the questionnaire.

a. Indicator 1 - Personnel Status. The status of the battalion's personnel has a direct impact on its ability to continue to fire and maneuver. This indicator includes consideration of personnel strength remaining as noncasualties, especially within the combat elements of the battalion (the "foxhole" strength). It also takes into account the command structure remaining in the battalion headquarters, companies, and platoons.

b. Indicator 2 - Status of Weapons, Equipment, Supplies, and Combat Service Support Capability. This indicator considers the operability of the battalion's major weapon systems and vehicles and its communications capability. It takes into account the ammunition and POL supplies remaining

in the unit and the capability of the division's combat service support system to resupply the battalion and to repair or replace its damaged weapons and equipment.

c. Indicator 3 - Combat Support Status. The availability of combat support is critical to the ability of the maneuver battalion to continue its assigned mission. This indicator considers specifically the field artillery support and the Army air and close air support available to the battalion.

d. Indicator 4 - Enemy Strength and Condition. The commander's perception of his enemy's strength, effectiveness, and intentions is critical to his assessment of his own unit's capabilities. This indicator covers those aspects of the battle situation.

e. Indicator 5 - Leader and Troop Quality. In addition to the tangible indicators described above, the commander must consider a number of subjective factors that bear on the ability of his unit to continue its assigned mission. Among the most important of these intangible indicators is the quality of leadership and the troop quality of the unit. This indicator considers the quality of leadership in the unit as manifested in such attributes as technical and organizational skills, facility in interpersonal relations, and problem-solving ability. Troop quality is considered in terms of such attributes as discipline, job proficiency, group cohesion, and morale.

3. SCENARIO

3-1. INTRODUCTION. This scenario presents the context in which you will be asked to make judgments concerning the 802d Mechanized Infantry Battalion. The scenario describes the friendly and threat forces of interest, the general and special situations, and the mission and activities of the 802d Mech.

3-2. GENERAL SITUATION. On 28 June 198_, USSR/Warsaw Pact forces launched a non-nuclear attack against NATO. The initial phase of the attack was aimed at destroying Allied defensive systems and capturing territory before adequate reinforcement could arrive from Great Britain and CONUS. NATO forces have offered much stronger resistance than had been anticipated by the Warsaw Pact, and the attack in the North German Plain was halted by determined resistance from NATO. Portions of the Red forces facing CENTAG units were withdrawn from the battle and moved north to reinforce the main Red attack. This permitted US forces of the X Corps (Notional) to re-establish defensive positions within 15km of the international border. Red forces are in the process of resuming offensive operations. Your battalion, the 802d Mech, is assigned to the 2d Brigade of the 21st Infantry Division (Mechanized) (Notional). The division has been in combat since the onset of hostilities and has fought elements of the two divisions as they penetrated the international border in the division sector. All units within the division have been in combat and have suffered varying degrees of combat loss. The maneuver battalions of the division vary

in effectiveness in proportion to their combat exposure. Units deploying from CONUS have been assigned elsewhere, and reinforcing units are not expected to become available to the division for some time. The division has been assigned the mission of defending in sector to deny the enemy two major avenues of approach.

3-3. THE BATTALION. The 802d Battalion (Mech) is a battalion task force composed of two mechanized infantry companies, a cross-attached tank company, a combat support company, and a headquarters and headquarters company. At full strength, it has the following major equipment items:

HHC - 6 command/command post vehicles
Co A - 20 APC, 3 81 mortars, 2 TOW, 9 Dragon, 27 LAW
Co B - 20 APC, 3 81 mortars, 2 TOW, 9 Dragon, 27 LAW
Co C (539 Armor Bn) - 17 M60A3, 1 APC
CS Co - 28 APC, 4 4.2in mortars, 16 TOW, 4 Dragon

Full strength totals for the battalion task force are thus 17 M60A3, 75 APC, 20 TOW, 22 Dragon, 6 81 mortars, 4 4.2in mortars, and 54 LAW. The 2d Brigade is supported by a direct support artillery battalion and a reinforcing artillery battalion, a total of 48 guns (155mm SP). Combat service support to the brigade is provided by the 5th Ordnance Company Ammunition Transfer Point and a forward support company from DISCOM, 21st ID.

3-4. SPECIAL SITUATION. It is now 11 July 198_, and the 802d Mech Battalion is defending in its assigned sector as an interior unit in the 2d Brigade sector. The covering force elements of the division, having engaged the enemy force, have passed through the battalion and moved to previously selected positions in the brigade rear. Local security units were withdrawn under pressure from Red recon units. Yesterday, on 10 July 198_, the 802d was attacked by the 20th Motorized Rifle Regiment (Reinforced) of the 18th Motorize Rifle Division (Notional). The 20th attacked with three motorized rifle battalions abreast in the first echelon closely followed by a tank battalion. Artillery from the regiment and division artillery groups fired a 40-minute preparation immediately before the attack. Although the preparatory fires were largely ineffective in destroying the 802d's vehicles, they did provide suppression, allowing the Red forces to approach elements of the 802d fairly closely before being engaged. The ensuing battle lasted for several hours before the Red side was forced to break off and withdraw to positions occupied prior to the attack. The battalion is now regrouping while continuing to perform its mission. The capabilities and intentions of the Red forces are presently being assessed by intelligence experts. You, as battalion commander, are evaluating the effectiveness of the battalion to decide if it needs to be reconstituted.

4. QUESTIONNAIRE

4-1. GENERAL. This questionnaire is subdivided into two parts. The first part presents combat profiles for the 802d Battalion and asks questions concerning unit effectiveness and the need for reconstitution. The second part of the questionnaire is designed to gather data on the respondent and the effectiveness of the questionnaire.

4-2. SPECIFIC INSTRUCTIONS - PART 1. The combat profiles show the condition of the 802d Battalion after combat on 10 July 198_ in terms of the five combat indicators previously discussed. (Obviously, a multitude of factors will be involved in determining unit status under actual conditions. However, the analysis can handle only a small number. Please limit your consideration to the five key indicators as defined.) After reading and analyzing each profile you must answer two questions.

a. The first question asks you to evaluate the battalion's chance of success in continuing its assigned mission to defend against the impending Red attack under the conditions described by the indicators in the profile. Your answer is indicated by marking a space on the 9-point scale illustrated in Figure 1. The scale represents a range of values from low to high that indicates your perception of the battalion's chance of success in continuing its mission. For example, if after evaluating a profile you feel that the unit's chance of continuing its mission successfully is about 70/30, you would mark the "7" space on the scale, as shown on the figure.

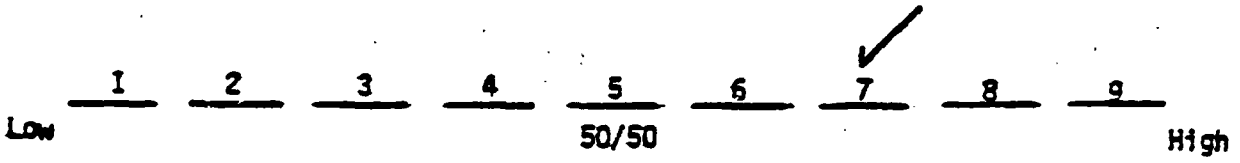

Figure 1

b. The second question asks if the unit needs to be reconstituted. Limit your consideration to the simple question of need, rather than considering specifics such as how and when to reconstitute. Indicate your answer by circling either "yes" or "no".

4-3. SPECIFIC INSTRUCTIONS - PART 2. Following the profiles is a series of questions designed to aid in validating test results. Please answer all questions.

PART 1

COMBAT PROFILES

Combat Support Status

Fire support is available on call from one FA battalion, and close air support mission response has been about 50%.

Personnel Status

One field grade officer was lost, but 70% of the company command structure is intact and foxhole strength is at 65%.

Enemy Strength

The enemy is perceived to be at about 65% strength with limited offensive capability.

Equipment, Supply, CSS Status

Major weapons and equipment are operable, and refuel/resupply assets are intact and functioning.

Leadership/Troop Quality

Training and morale among troops is about average, and leaders have various levels of experience.

What is your evaluation of the battalion's chance of success in continuing its assigned mission?

1	2	3	4	5	6	7	8	9
Low				50/50				High

Does the battalion need to be reconstituted? Yes No

Enemy Strength

The enemy is perceived to be at about 65% strength with limited offensive capability.

Equipment, Supply, CSS Status

55% of the battalion's major weapon systems are operable, and refuel/resupply systems are functioning but availability is curtailed.

Combat Support Status

The battalion does not have priority for DS assets, and close air support is not available.

Personnel Status

More than half the battalion's leaders were lost, and foxhole strength is less than 40%.

Leadership/Troop Quality

Training and experience levels among troops and leaders is low, and morale is poor.

What is your evaluation of the battalion's chance of success in continuing its assigned mission?

1	2	3	4	5	6	7	8	9

Low 50/50 High

Does the battalion need to be reconstituted? Yes No

(11) Combat Support Status

The battalion has priority of fires from DS artillery, and close air support and army air are on call as needed.

Leadership/Troop Quality

Training and experience levels among troops and leaders is low, and morale is poor.

Personnel Status

One field grade officer was lost, but 70% of the company command structure is intact and foxhole strength is at 65%.

Equipment, Supply, CSS Status

55% of the battalion's major weapon systems are operable, and refuel/resupply systems are functioning but availability is curtailed.

Enemy Strength

The enemy is reported to be at 85% strength and capable of a fully supported attack.

What is your evaluation of the battalion's chance of success in continuing its assigned mission?

1	2	3	4	5	6	7	8	9
Low				50/50				High

Does the battalion need to be reconstituted? Yes No

Equipment, Supply, CSS Status

55% of the battalion's major weapon systems are operable, and refuel/resupply systems are functioning but availability is curtailed.

Leadership/Troop Quality

Training and morale among troops is about average, and leaders have various levels of experience.

Personnel Status

One field grade officer was lost, but 70% of the company command structure is intact and foxhole strength is at 65%.

Combat Support Status

The battalion does not have priority for DS assets, and close air support is not available.

Enemy Strength

The enemy is perceived to be at about 65% strength with limited offensive capability.

What is your evaluation of the battalion's chance of success in continuing its assigned mission?

1	2	3	4	5	6	7	8	9
Low				50/50				High

Does the battalion need to be reconstituted? Yes No

Note: Additional profiles are omitted from this report. Each questionnaire package contained 60 profiles.

PART 2

DEBRIEFING

Your responses to the following questions are a critical part of this questionnaire. We encourage your comments and suggestions.

1. Rank _____

2. Branch (circle one): Infantry Armor

3. Highest level staff (duration in months):

Corps_____ Division_____ Brigade_____ Battalion_____

4. Duration of command time (months) _____

5. Combat experience: Yes (duration in months) _____ No _____

6. Written instructions were given to you with the questionnaire. How clear were the instructions? (Circle one)

Not Clear At All | Somewhat Unclear | Unsure | Adequate | Very Clear

Comments:

7. A scenario was given to you to provide the context for your evaluations. How adequate was the scenario for this purpose? (Circle one)

Totally Inadequate | Inadequate | Unsure | Adequate | More than Adequate

Comments:

8. A set of five indicators of combat effectiveness potential was identified for this task. Do you agree that these indicators, in general, are the right ones for determining combat effectiveness potential in a combat situation?

Strongly Disagree Disagree Unsure Agree Strongly Agree

Comments:

9. Was the information given to you about the indicators in the profiles adequate for you to make the evaluations asked for? (Circle one)

Totally Inadequate Inadequate Unsure Adequate More than Adequate

Comments:

10. How confident are you that your evaluations for the profiles were accurate and realistic? (Circle one)

Not at all Confident Somewhat Unconfident Unsure Fairly Confident Confident

Comments:

APPENDIX C

EXTENDED ANALYSIS

APPENDIX C

EXTENDED ANALYSIS

C-1. INTRODUCTION. Following an information briefing on the work documented in this report, Deputy Commander, US Army Combined Arms Combat Developments Activity (CACDA) directed that the analysis be extended by sampling groups of officers with education and experience levels different from those of the Command and General Staff College respondents. Specifically, the DCDR suggested that Infantry and Armor students at the US Army War College and Advanced Course students at the US Army Infantry School and US Army Armor School be sampled. The questionnaire was administered at these schools in October 1981. The results are documented in this appendix.

C-2. ARMY WAR COLLEGE.

a. Informational Data. Instructors at the Army War College distributed questionnaires to Infantry and Armor officers, who completed the questionnaires outside of class time. A total of 56 were completed and returned. Table C-1 summarizes information collected on respondent rank, branch, highest level staff position held and duration, highest level command held and duration, and duration of combat experience. Table C-2 summarizes responses to the multiple choice questions at the end of the questionnaire.

b. Respondent Comments. Twenty-one of the 56 respondents, or 37.5 percent, provided written comments on their questionnaire forms. No consistent theme emerged from the comments other than the obvious difficulty of evaluating data to reach simulated decisions in abstract situations.

c. Descriptive Statistics.

(1) The total number of possible reconstitution decisions was 56 x 60 = 3360. Six decisions were missing from the data, leaving a total of 3354. Figure C-1 shows that 1316 of these decisions, or 39 percent, were that reconstitution is needed; 2038, or 61 percent, were the reconstitution is not needed.

(2) A total of 3357 ratings were obtained on the unit's chances of being able to continue its mission successfully under the conditions presented by the profiles. Figure C-2 shows that these ratings, collected on a scale from 1 to 9, approached a normal distribution. The mean effectiveness rating was 5.167 with a standard deviation of 1.859. Table C-3 illustrates that the entire scale was used in the effectiveness ratings. The profile in which all the indicators were favorable to the evaluated unit received the highest ranking, with a mean of 8.750 and a standard deviation of .500. The profile in which all indicators were unfavorable received the lowest ranking, with a mean of 2.118 and a standard deviation of .697.

(3) Figure C-3 shows a plot of the decisions on need for reconstitution versus the effectiveness ratings. The plot shows that for

Table C-1 . Summary of respondent military experience, Army War College.

Number of Respondents: 56

Rank: COL - 5, LTC - 51

Branch: Infantry - 38, Armor - 18

Highest Level Staff Position:

Level	Number of Respondents	Average Duration in Months
Corps	17	14
Division	20	14
Brigade	9	27
Battalion	3	34
None or No Response	7	--

Combat Time: Average duration in months - 23 (53 responses)

Highest Level Command:

Level	Number of Respondents	Average Duration in Months
Corps	0	0
Division	0	0
Brigade	1	24
Battalion	48	23
None or No Response	7	--

Table C-2. Summary of responses to informational questions, Army War College.

Questions	Number of Respondents	Percent
Written instructions were given to you with the questionnaire. How clear were the instructions?		
Not clear at all	1	2
Somewhat unclear	4	7
Unsure	2	4
Adequate	35	62
Very clear	14	25
No response	0	0
A scenario was given to you to provide the context for your evaluations. How adequate was the scenario for this purpose?		
Totally inadequate	0	0
Inadequate	5	9
Unsure	7	12
Adequate	35	63
More than adequate	9	16
No response	0	0
A set of five indicators of combat effectiveness potential was identified for this task. Do you agree that these indicators, in general, are the right ones for determining combat effectiveness potential in a combat situation?		
Strongly disagree	0	0
Disagree	4	7
Unsure	4	7
Agree	45	81
Strongly agree	3	5
No response	0	0
Was the information given to you about the indicators in the profiles adequate for you to make the evaluations asked for?		
Totally inadequate	0	0
Inadequate	3	5
Unsure	9	16
Adequate	40	72
More than adequate	4	7
No response	0	0
How confident are you that your evaluations for the profiles were accurate and realistic?		
Not at all confident	3	5
Somewhat unconfident	7	13
Unsure	13	23
Fairly confident	26	46
Confident	7	13
No response	0	0

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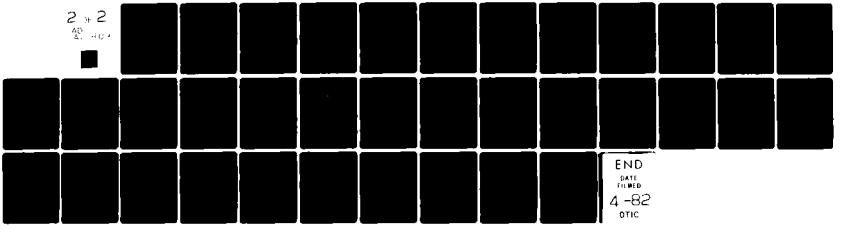

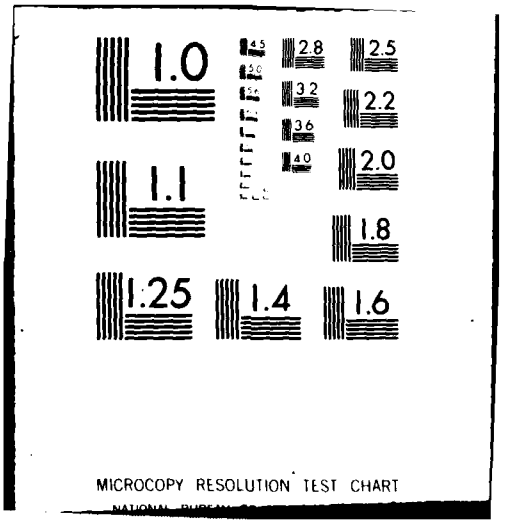
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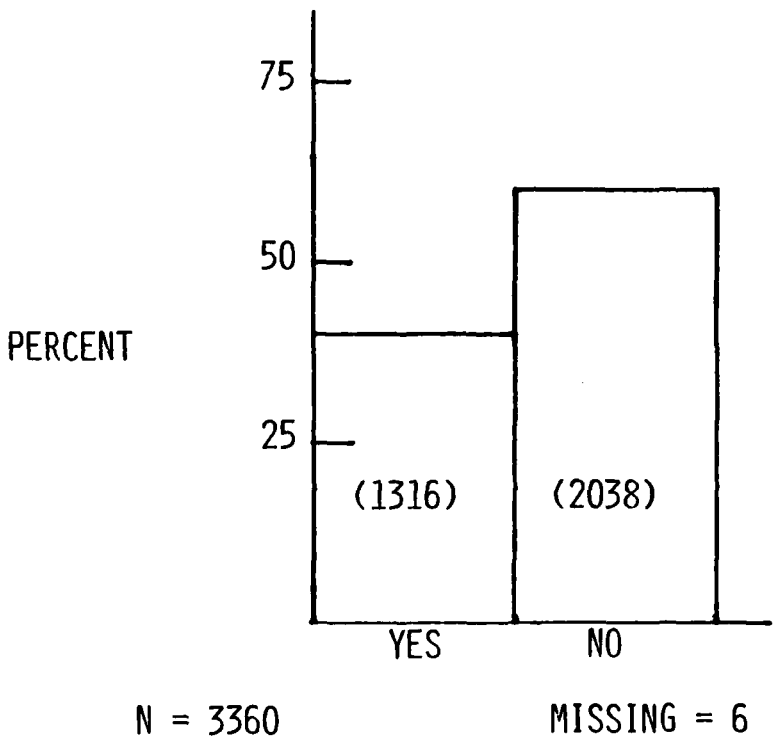

Figure C-1. Decisions on need for reconstitution, Army War College.

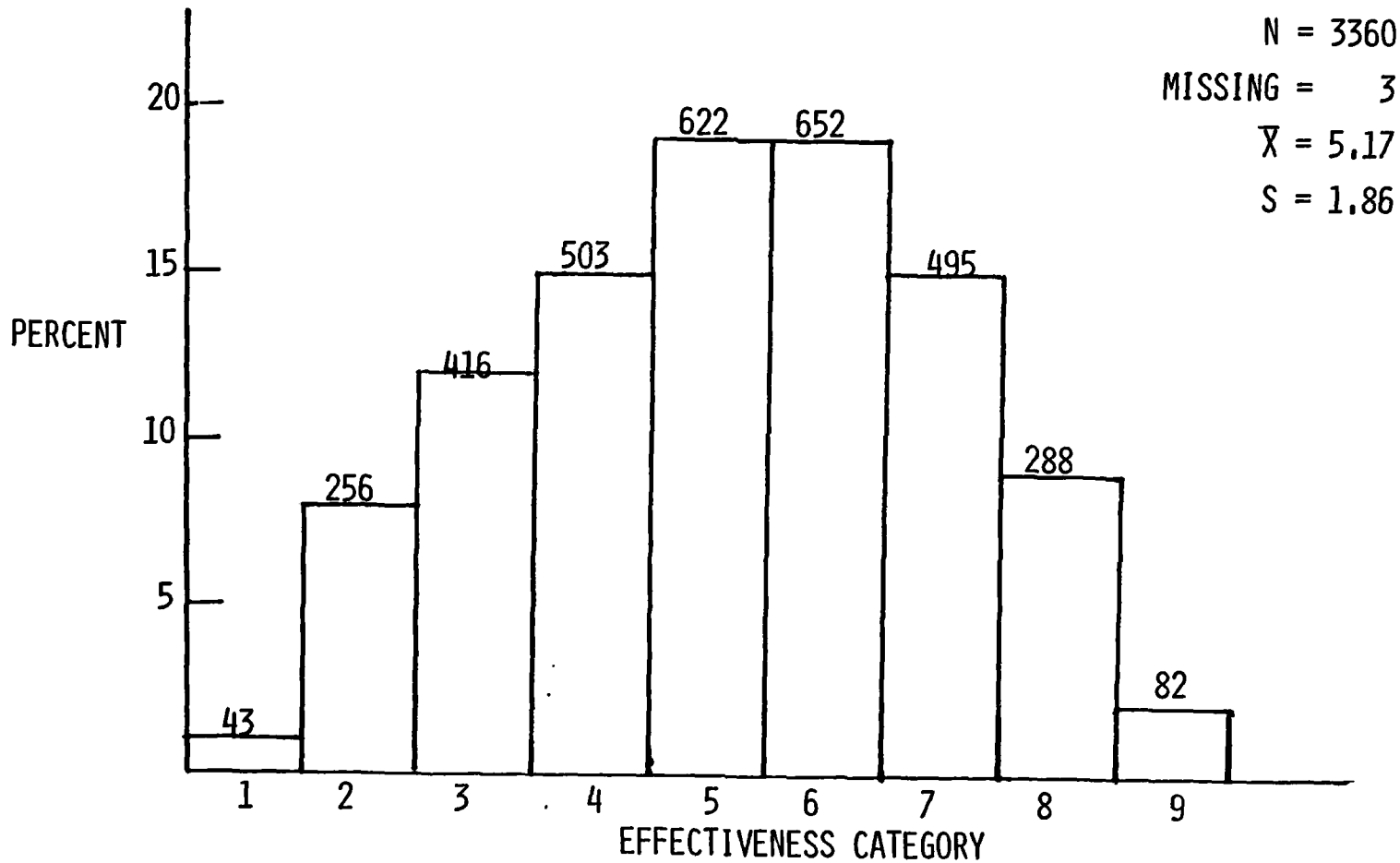

Figure C-2. Ratings of combat effectiveness potential, Army War College.

Table C-3. Profile extremes, Army War College.

	Highest Ranking Profile	Lowest Ranking Profile
Personnel	High	Low
Equipment	High	Low
Combat Support	High	Low
Enemy Situation	Low	High
Leadership/Troop Quality	High	Low
Mean Effectiveness	8.750	2.118
Standard Deviation	.500	.697

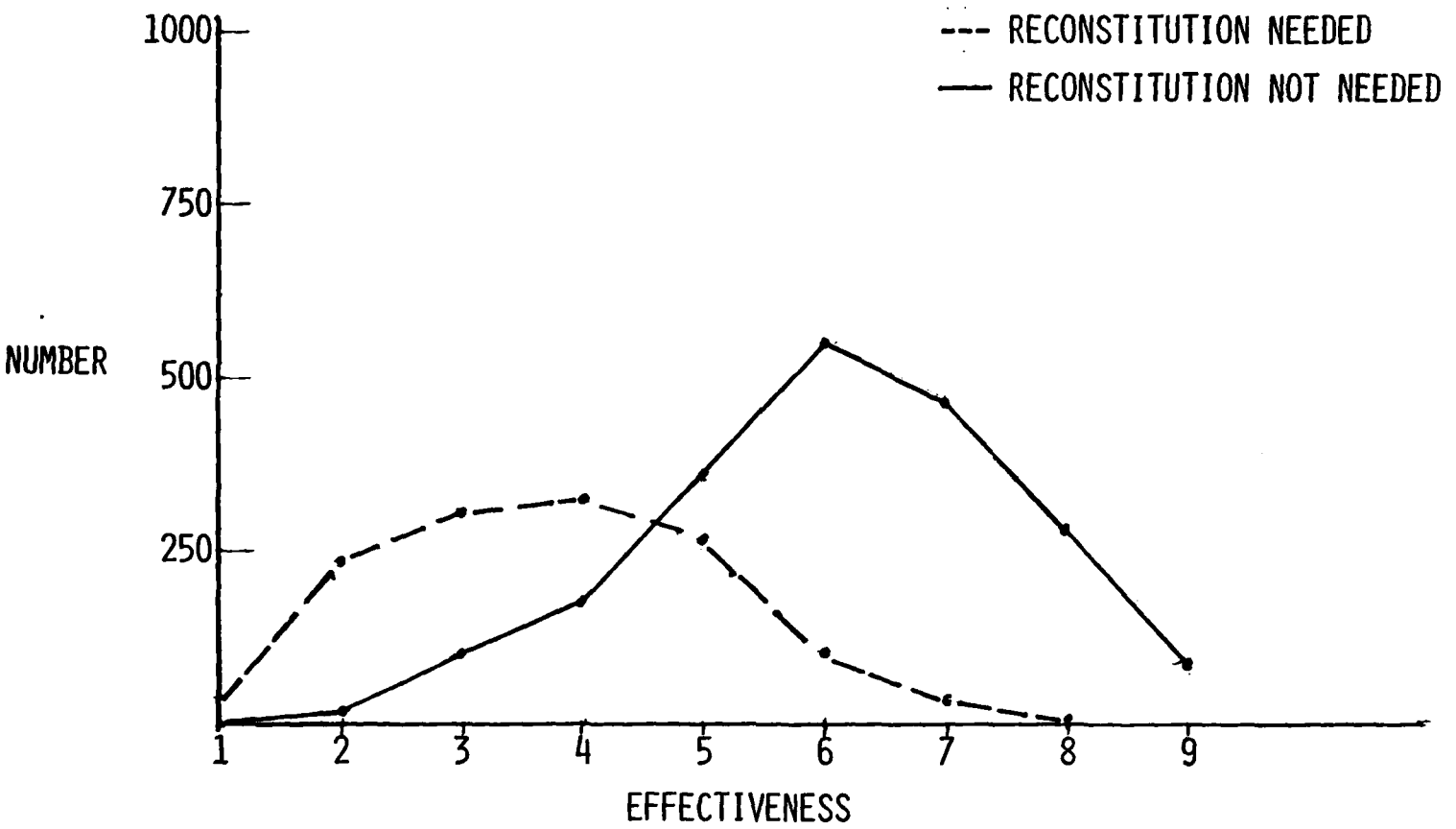

Figure C-3. Need for reconstitution versus effectiveness ratings, Army War College.

effectiveness ratings from 1 to 4, most respondents felt that the unit needed to be reconstituted. For ratings from 6 to 9, most decided that the unit did not need reconstitution. The area of effectiveness ratings of from 4 to 6 was the most obvious area of uncertainty on the need for reconstitution.

d. Path Analysis. The Army War College questionnaire data were analyzed by the path analysis techniques described in chapter 6 of the main report. The results, with all paths included, are shown in figure C-4 and table C-4. It is apparent that personnel status is the only indicator exerting a pronounced direct effect on the reconstitution decision. All exogenous variables except combat support status combine with overall effectiveness to produce small indirect effects. In terms of total effect, personnel status and equipment status dominate the other three variables. The reduced causal model, with near-zero paths eliminated, is shown in figure C-5.

C-3. INFANTRY SCHOOL.

a. Informational Data. Instructors of the Advanced Course at the Infantry School distributed questionnaires to students, who completed the questionnaires during class time. A total of 67 were completed and returned. Table C-5 summarizes information collected on respondent rank, branch, highest level staff position held and duration, highest level command held and duration, and duration of combat experience. Table C-6 summarizes responses to the multiple choice questions at the end of the questionnaire.

b. Respondent Comments. Twenty-nine of the 67 respondents, or 43 percent, provided written comments on their questionnaire forms. A common theme of several comments was relative unfamiliarity with the concept and operations of reconstituition at the battalion level and difficulty with the decision processes involved.

c. Descriptive Statistics.

(1) The total number of possible reconstitution decisions was 67 x 60 = 4020. Four decisions were missing from the data, leaving a total of 4016. Figure C-6 shows that 1442 of these decisions, or 36 percent, were that reconstitution is needed; 2574, or 64 percent, were that reconstitution is not needed.

(2) A total of 4020 ratings were obtained on the unit's chances of being able to continue its mission successfully under the conditions presented by the profiles. Figure C-7 shows that these ratings, collected on a scale from 1 to 9, approached a normal distribution. The mean effectiveness rating was 5.64 with a standard deviation of 1.75. Table C-7 shows that the highest ranking profile received a mean effectiveness rating of 8.529 with a standard deviation of .514. The lowest ranking profile received a mean effectiveness rating of 2.188 with a standard deviation of 1.047.

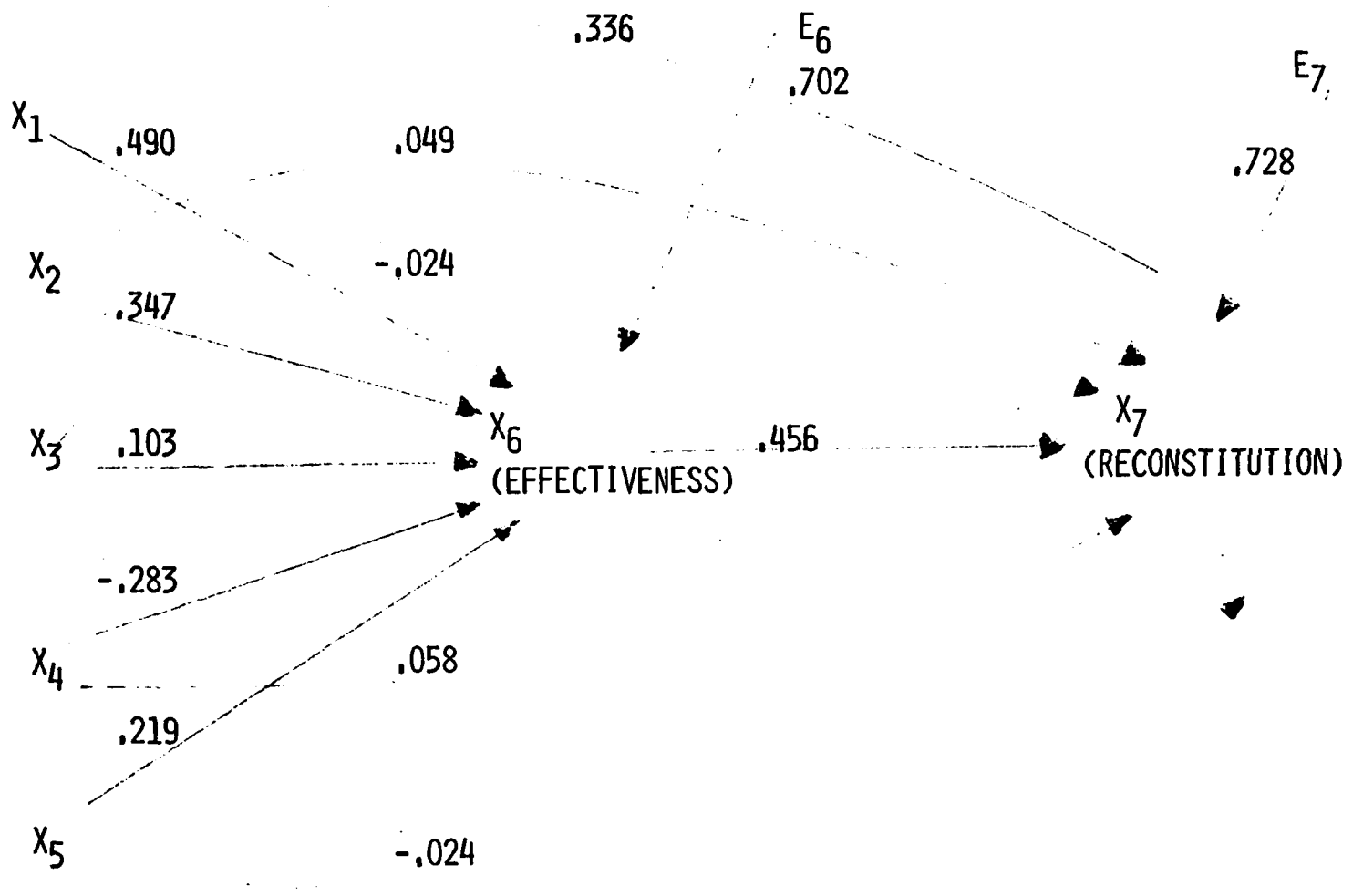

Figure C-4. Path coefficients for the reconstitution decision with all paths included, Army War College.

Table C-4. Direct and indirect effects of the five exogenous variables on the reconstitution decision, Army War College.

Variable	Direct	Indirect	Total
Personnel (X1)	.336	.223	.559
Equipment (X2)	.049	.158	.207
Combat Support (X3)	-.024	.047	.023
Enemy Situation (X4)	.058	-.129	-.071
Leadership/Troop Quality (X5)	-.024	.100	.076

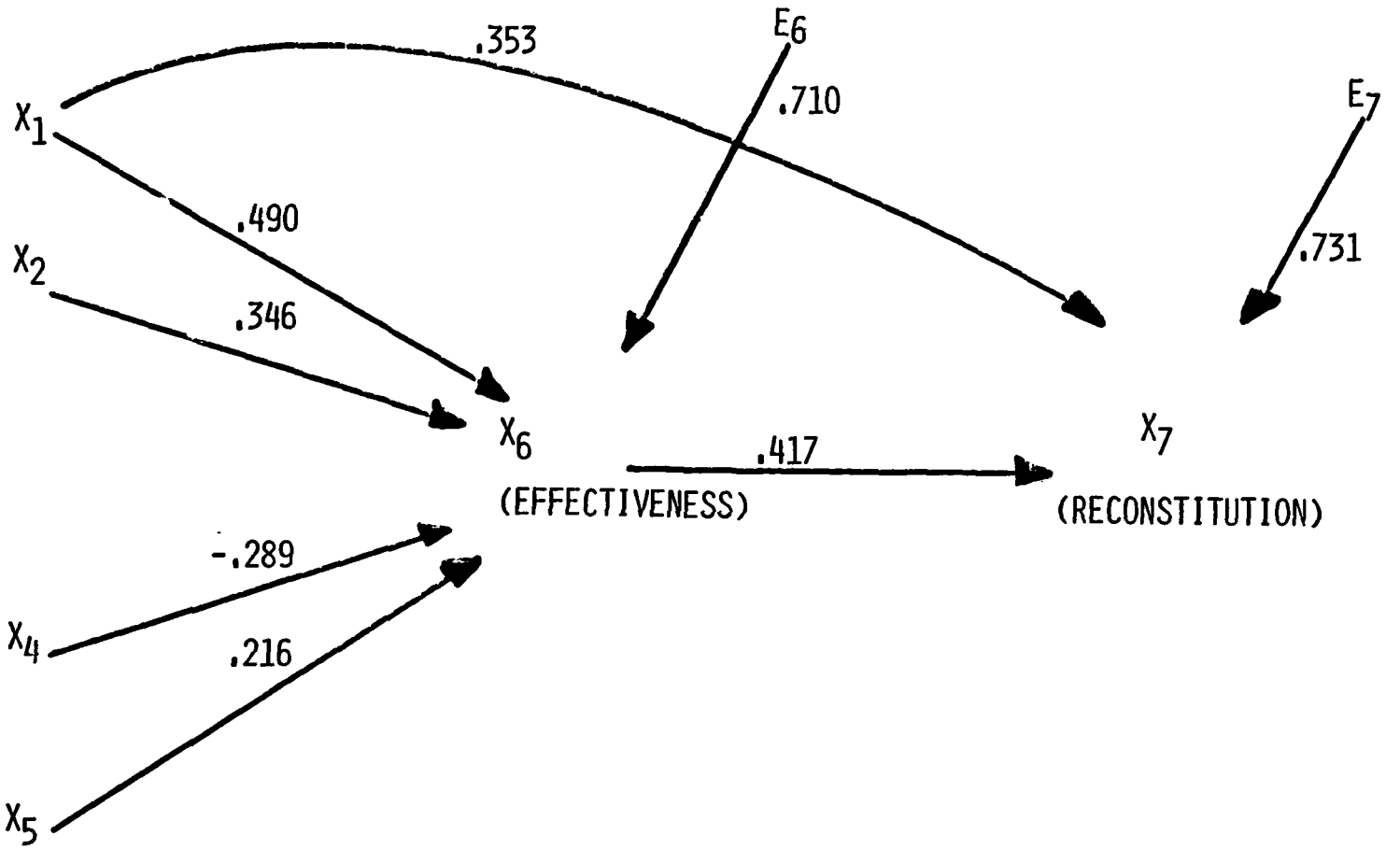

Figure C-5. Reduced causal model, Army War College.

Table C-5. Summary of respondent military experience, Infantry School.

Number of Respondents: 67

Rank: CPT - 67

Branch: Infantry - 67.

Highest Level Staff Position:

Level	Number of Respondents	Average Duration in Months
Corps	2	12
Division	3	14
Brigade	4	7
Battalion	29	11
None or No Response	29	--

Combat Time: Average duration in months - 11 (4 responses)

Highest Level Command:

Level	Number of Respondents	Average Duration in Months
Corps	0	--
Division	0	--
Brigade	0	--
Battalion	0	--
None or No Response	67	--

Table C-6. Summary of responses to informational questions, Infantry School.

Questions	Number of Respondents	Percent
Written instructions were given to you with the questionnaire. How clear were the instructions?		
Not clear at all	0	0
Somewhat unclear	2	3
Unsure	4	6
Adequate	37	55
Very clear	24	36
No response	0	0
A scenario was given to you to provide the context for your evaluations. How adequate was the scenario for this purpose?		
Totally inadequate	1	1
Inadequate	6	9
Unsure	3	4
Adequate	54	82
More than adequate	3	4
No response	0	0
A set of five indicators of combat effectiveness potential was identified for this task. Do you agree that these indicators, in general, are the right ones for determining combat effectiveness potential in a combat situation?		
Strongly disagree	1	1
Disagree	0	0
Unsure	8	12
Agree	49	74
Strongly agree	9	13
No response	0	0
Was the information given to you about the indicators in the profiles adequate for you to make the evaluations asked for?		
Totally inadequate	1	1
Inadequate	4	6
Unsure	6	9
Adequate	49	74
More than adequate	6	9
No response	1	1
How confident are you that your evaluations for the profiles were accurate and realistic?		
Not at all confident	1	1
Somewhat unconfident	2	3
Unsure	12	18
Fairly confident	44	66
Confident	7	11
No response	1	1

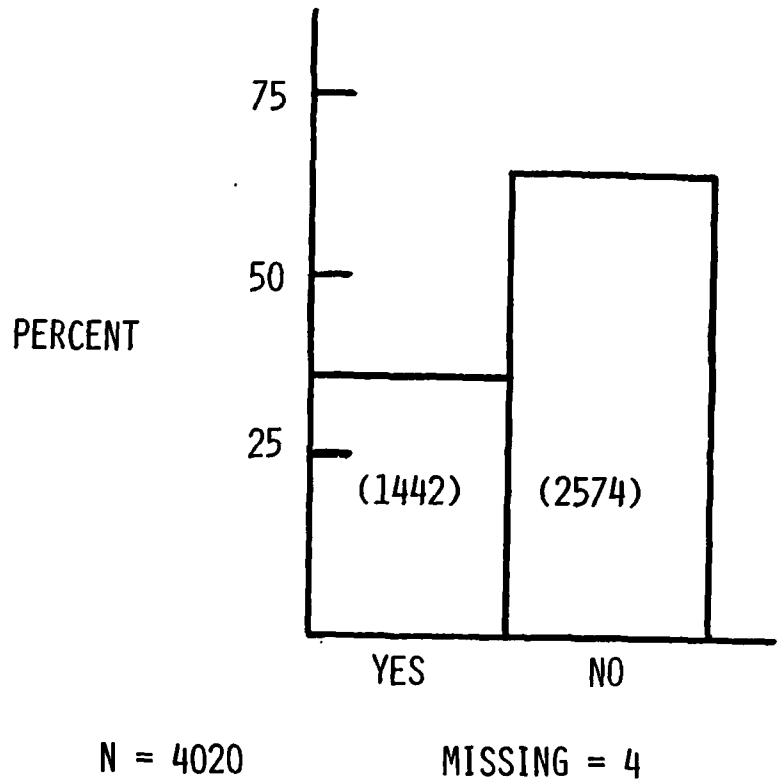

Figure C-6. Decisions on need for reconstitution, Infantry School.

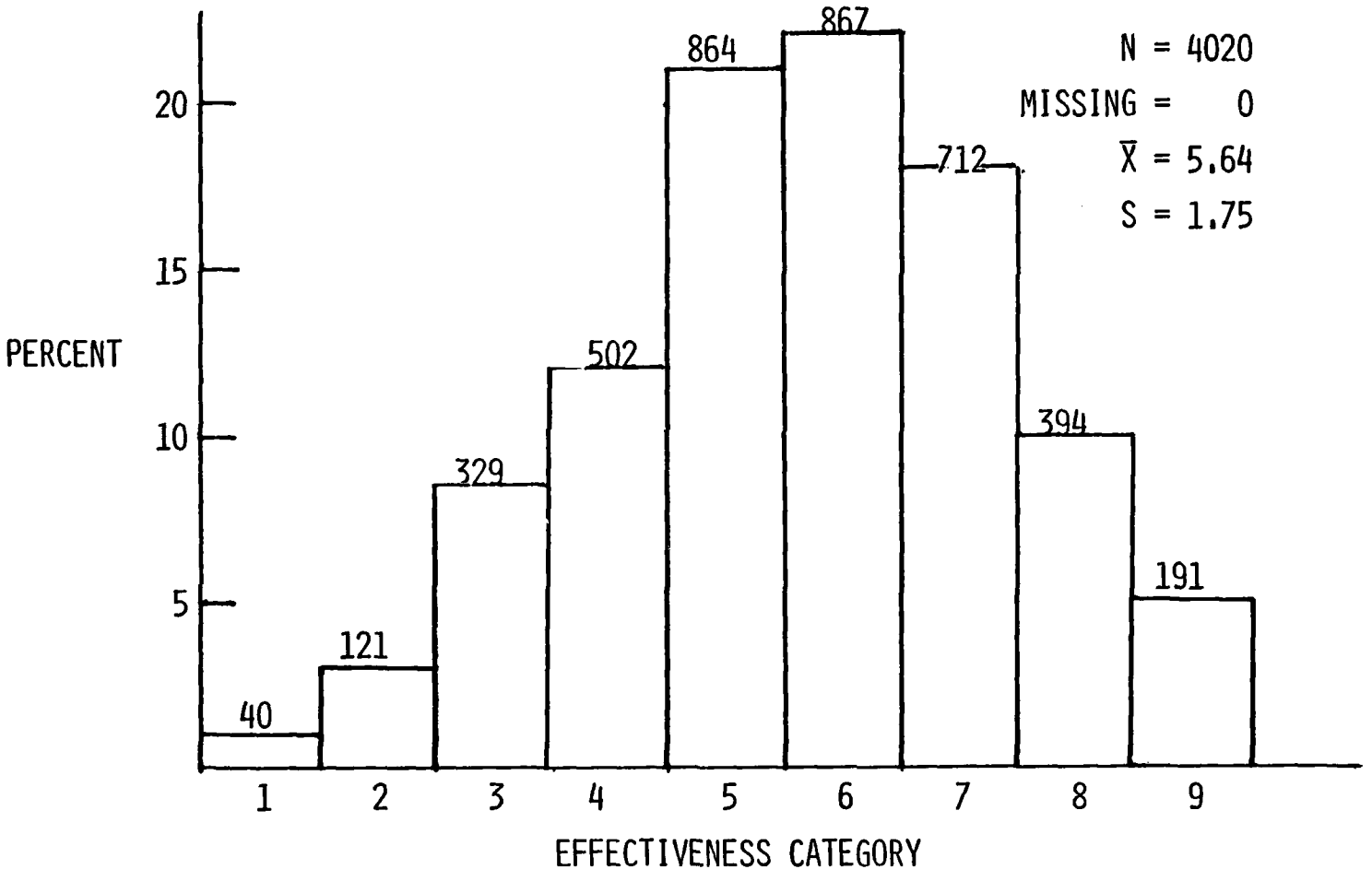

Figure C-7. Ratings of combat effectiveness potential, Infantry School.

Table C-7. Profile extremes, Infantry School.

	Highest Ranking Profile	Lowest Ranking Profile
Personnel	High	Low
Equipment	High	Low
Combat Support	High	Low
Enemy Situation	Low	High
Leadership/Troop Quality	High	Low
Mean Effectiveness	8.529	2.188
Standard Deviation	.514	1.047

(3) Figure C-8 shows a plot of the decisions on need for reconstitution versus the effectiveness ratings. The plot shows that for effectiveness ratings from 1 to 4, most respondents felt that the unit needed to be reconstituted. For ratings from 6 to 9, most decided that the unit did not need reconstitution. The area of effectiveness ratings of from 4 to 6 was obviously an area of uncertainty on the need for reconstitution.

d. Path Analysis. The Infantry School questionnaire data were analyzed by the path analysis techniques described in chapter 6. The results, with all paths included, are shown in figure C-9 and table C-8. Both personnel status and equipment status indicators exerted a direct effect on the reconstitution decision, with the other three exogenous variables having negligible direct effect. All exogenous variables except combat support status combined with overall effectiveness to produce fairly balance indirect effects. Personnel status and equipment status tend to dominate the other three variables in terms of toal effect. The reduced causal model, with near-zero paths eliminated, is shown in figure C-10.

C-4. ARMOR SCHOOL.

a. Informational Data. Instructors of the Advanced Course at the Armor School distributed questionnaires to students, who completed the questionnaires during class time. A total of 66 were completed and returned. Table C-9 summarizes information collected on respondent rank, branch, highest level staff position held and duration, highest level command held and duration, and duration of combat experience. Table C-10 summarizes responses to the multiple choice questions at the end of the questionnaire.

b. Respondent Comments. Nineteen of the 66 respondents, or 29 percent, provided written comments on their questionnaire forms. The comments tended to emphasize inexperience of the respondents in the decision processes associated with reconstitution.

c. Descriptive Statistics.

(1) The total number of possible reconstitution decisions was 66 x 60 = 3960. Thirty-four decisions were missing from the data, leaving a total of 3926. Figure C-11 shows that 1777 of these decisions, or 45 percent, were that reconstitution is needed; 2149, or 55 percent, were that reconstitution is not needed.

(2) A total of 3932 ratings were obtained on the unit's chances of being able to continue its mission successfully under the conditions presented by the profiles. Figure C-12 shows that these ratings, collected on a scale from 1 to 9, approached a normal distribution. The mean effectiveness rating was 5.546 with a standard deviation of 1.820. Table C-11 shows that the highest ranking profile received a mean effectiveness rating of 8.588 with a standard deviation of .795. The lowest ranking profile received a mean effectiveness rating of 2.250 with a standard deviation of 1.183.

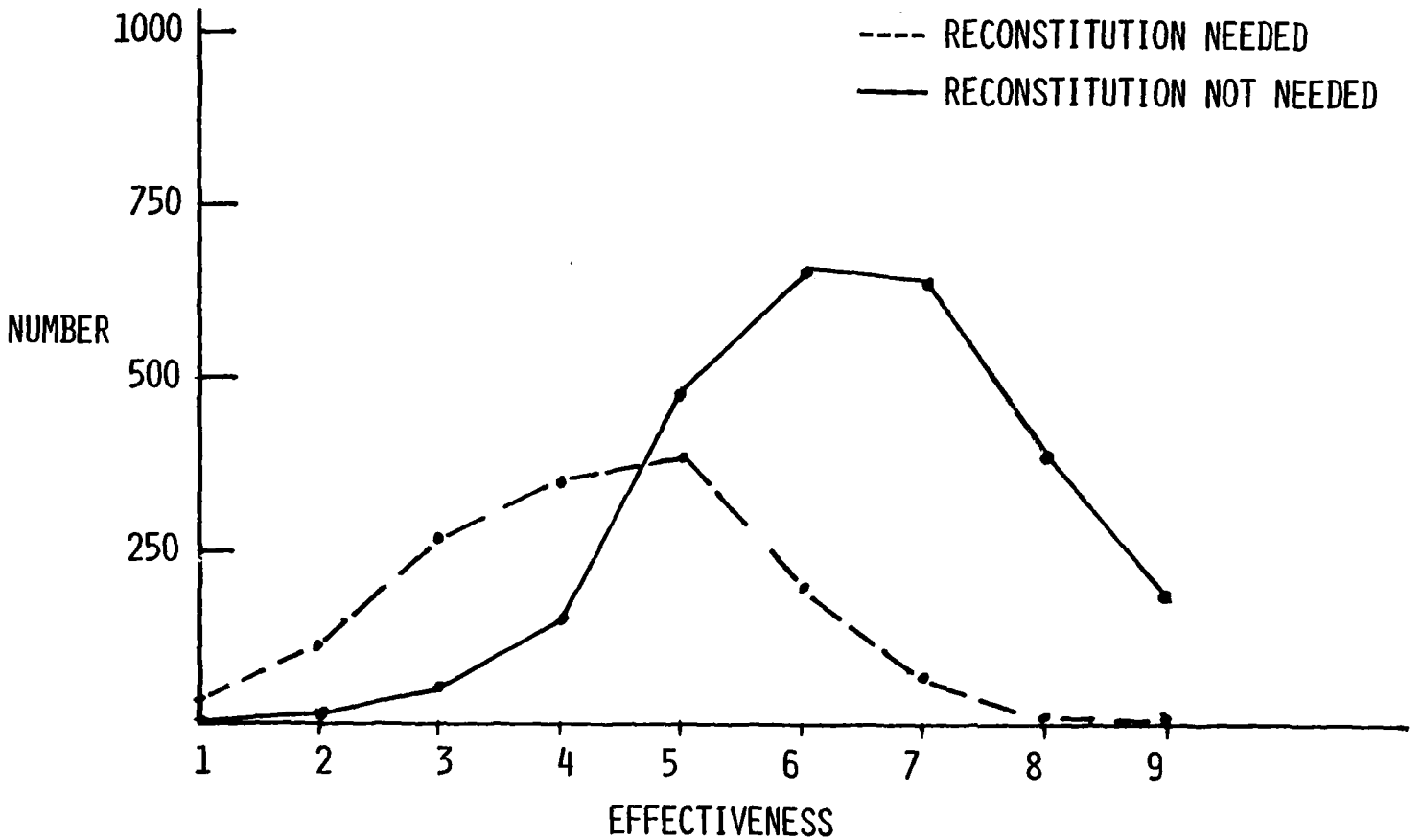

Figure C-8. Need for reconstitution versus effectiveness ratings, Infantry School.

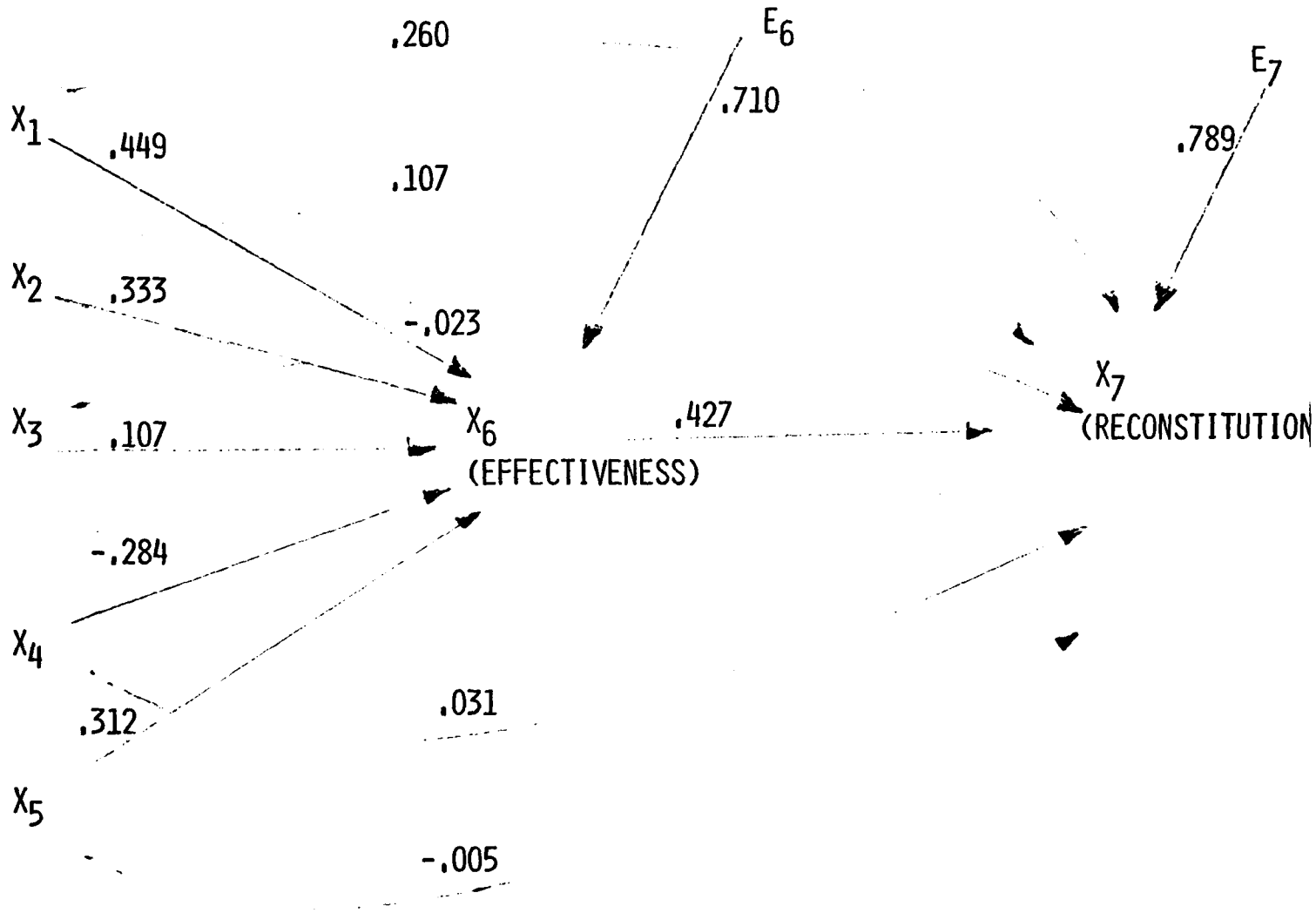

Figure C-9. Path coefficients for the reconstitution decision with all paths included, Infantry School.

Table C-8. Direct and indirect effects of the five exogenous variables on the reconstitution decision, Infantry School.

Variable	Direct	Indirect	Total
Personnel (X1)	.260	.192	.452
Equipment (X2)	.107	.142	.249
Combat Support (X3)	-.023	.046	.023
Enemy Situation (X4)	.031	-.121	-.090
Leadership/Troop Quality (X5)	-.005	.133	.128

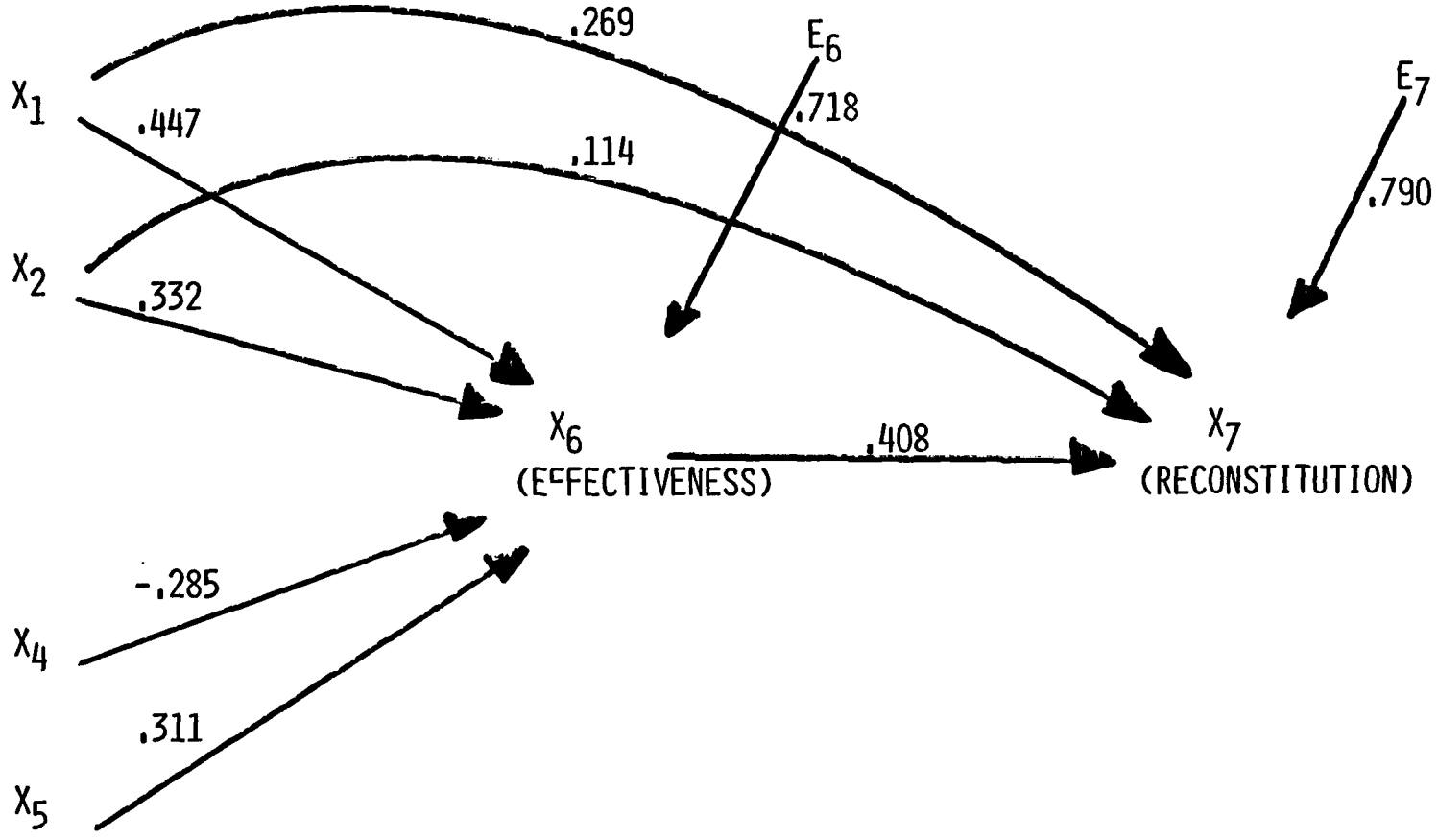

Figure C-10. Reduced causal model, Infantry School.

Table C-9 . Summary of respondent military experience, Armor School.

Number of Respondents: 66

Rank: CPT - 61, LT - 4, No Response - 1.

Branch: Infantry - 13, Armor - 50, No Response - 3

Highest Level Staff Position:

Level	Number of Respondents	Average Duration in Months
Corps	0	--
Division	8	15
Brigade	7	10
Battalion	26	13
None or No Response	25	--

Combat Time: Average duration in months - 10 (1 response)

Highest Level Command:

Level	Number of Respondents	Average Duration in Months
Corps	0	--
Division	0	--
Brigade	0	--
Battalion	0	--
None or No Response	66	--

Table C-10 Summary of responses to informational questions, Armor School.

Questions	Number of Respondents	Percent
Written instructions were given to you with the questionnaire. How clear were the instructions?		
Not clear at all	1	2
Somewhat unclear	3	5
Unsure	2	3
Adequate	49	74
Very clear	10	15
No response	1	1
A scenario was given to you to provide the context for your evaluations. How adequate was the scenario for this purpose?		
Totally inadequate	1	1
Inadequate	3	5
Unsure	3	5
Adequate	54	82
More than adequate	4	6
No response	1	1
A set of five indicators of combat effectiveness potential was identified for this task. Do you agree that these indicators, in general, are the right ones for determining combat effectivenss potential in a combat situation?		
Strongly disagree	0	0
Disagree	1	1
Unsure	15	24
Agree	41	62
Strongly agree	8	12
No response	1	1
Was the information given to you about the indicators in the profiles adequate for you to make the evaluations asked for?		
Totally inadequate	0	0
Inadequate	6	9
Unsure	9	14
Adequate	46	70
More than adequate	4	6
No response	1	1
How confident are you that your evaluations for the profiles were accurate and realistic?		
No at all confident	3	5
Somewhat unconfident	5	8
Unsure	24	36
Fairly confident	28	42
Confident	6	9
No response	0	0

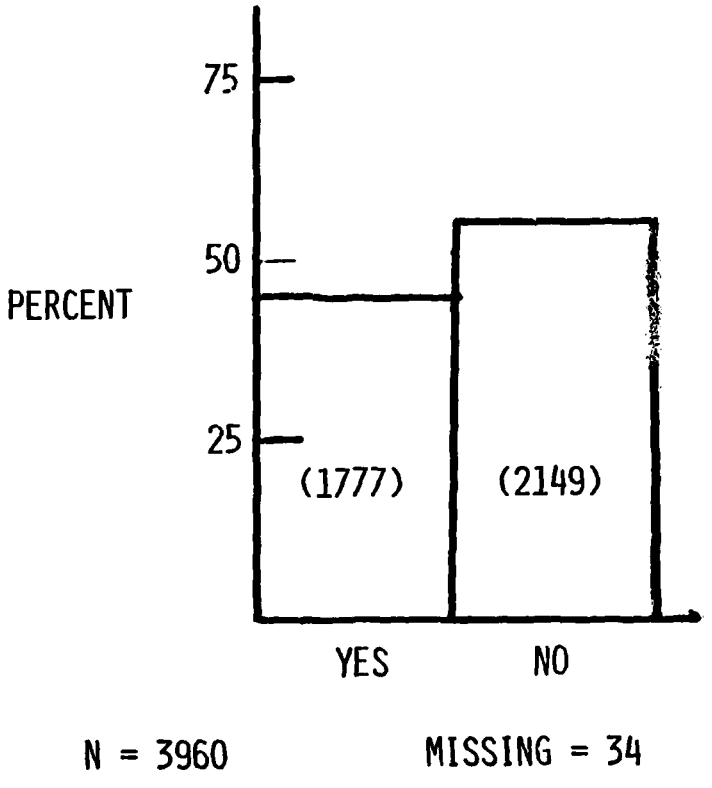

Figure C-11. Decisions on need for reconstitution, Armor School.

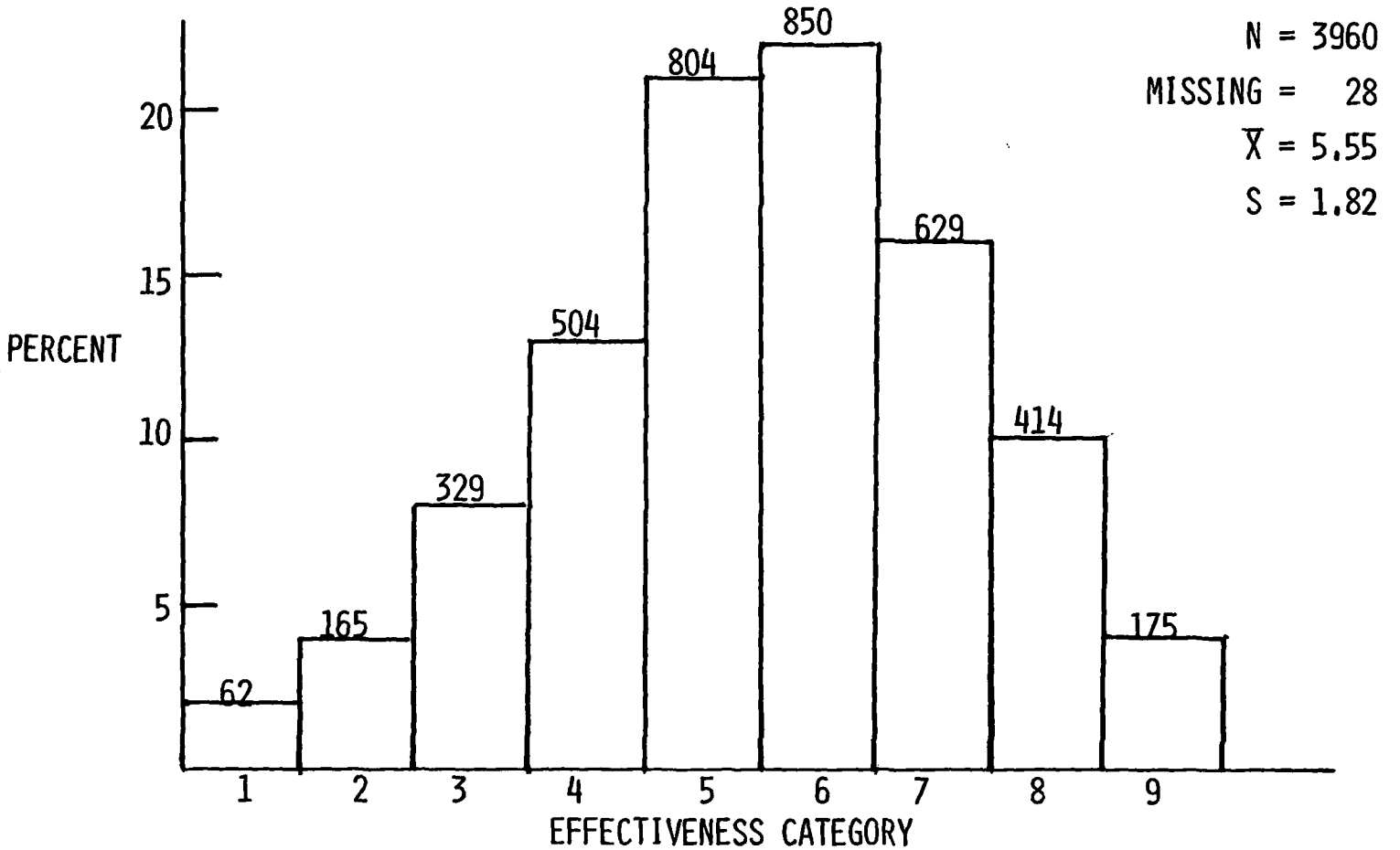

Figure C-12. Ratings of combat effectiveness potential, Armor School.

Table C-11. Profile extremes, Armor School.

	Highest Ranking Profile	Lowest Ranking Profile
Personnel	High	Low
Equipment	High	Low
Combat Support	High	Low
Enemy Situation	Low	High
Leadership/Troop Quality	High	Low
Mean Effectiveness	8.588	2.250
Standard Deviation	.795	1.183

(3) Figure C-13 shows a plot of the decisions on need for reconstitution versus the effectiveness ratings. The plot shows that for effectiveness ratings from 1 to 4, most respondents felt that the unit needed to be reconstituted. For ratings from 6 to 9, most decided that the unit did not need reconstitution. The area of effectiveness ratings of from 4 to 6 was an area of uncertainty on the need for reconstitution.

d. Path Analysis. The Armor School questionnaire data were analyzed by path analysis techniques. The results, with all paths included, are shown in figure C-14 and table C-12. The personnel status and equipment status indicators exerted nearly equal direct effects on the reconstitution decision, with the other three exogenous variables having negligible direct effect. All exogenous variables except combat support combined with overall effectiveness to produce indirect effects. Personnel status and equiment status dominated the other three variables in terms of total effect. The reduced causal model, with near-zero paths eliminated, is shown in figure C-15.

C-5. DISCUSSION.

a. Informational Data.

(1) The summaries of information collected on respondent military experience (tables 6-1, C-1, C-5, and C-9) show that the respondents represent a wide range of command and combat experience. The Army War College (AWC) respondents, mostly lieutenant colonels, had an average of 23 months of combat experience. Eighty-five percent of the majors in the CGSC sample had combat experience, an average of 14 months. Only 4 percent of the Advanced Course respondents, who were mostly captains, reported combat time. Over 87 percent of the AWC respondents had command experience at the battalion level, while command experience of the other respondent groups was at company and below.

(2) In their responses to informational questions (tables 6-2, C-2, C-6, and C-10), the four groups did not seem to differ greatly. Table C-13 is a summary of the percent of respondents in each group responding favorably (responses 4 or 5) to each question. AWC and CGSC respondents answered similarly in the areas of questionnaire content; however, 69 percent of the CGSC respondents were confident of their evaluations as contrasted to 59 percent of AWC respondents. Responses from Advanced Course students were similar to those obtained from other groups except that 77 percent of Infantry School respondents were confident of their evaluations (the highest of the four groups) and 51 percent of Armor School respondents were confident (the lowest of the four groups). These results appear to be consistent in that Infantry School respondents reported the highest satisfaction with the indicators selected and the information provided (87 percent and 83 percent, respectively), while Armor School reported the lowest satisfaction with these items (74 percent and 76 percent, respectively).

b. Respondent Comments. Several respondents from both the Infantry School and the Armor School commented on the inexperience of officers at the Advanced Course level in making the reconstitution evaluations called for.

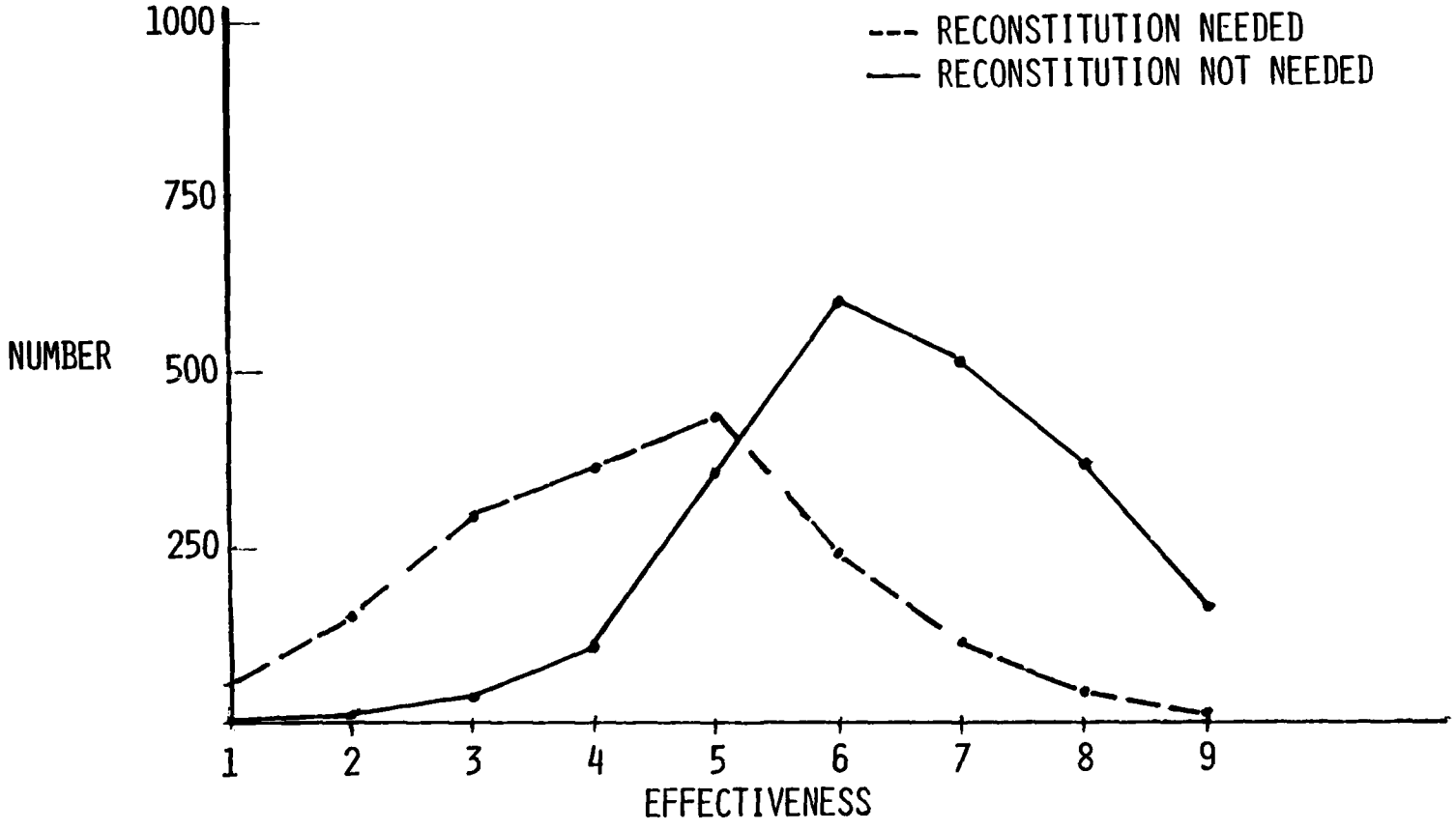

Figure C-13. Need for reconstitution versus effectiveness ratings, Armor School.

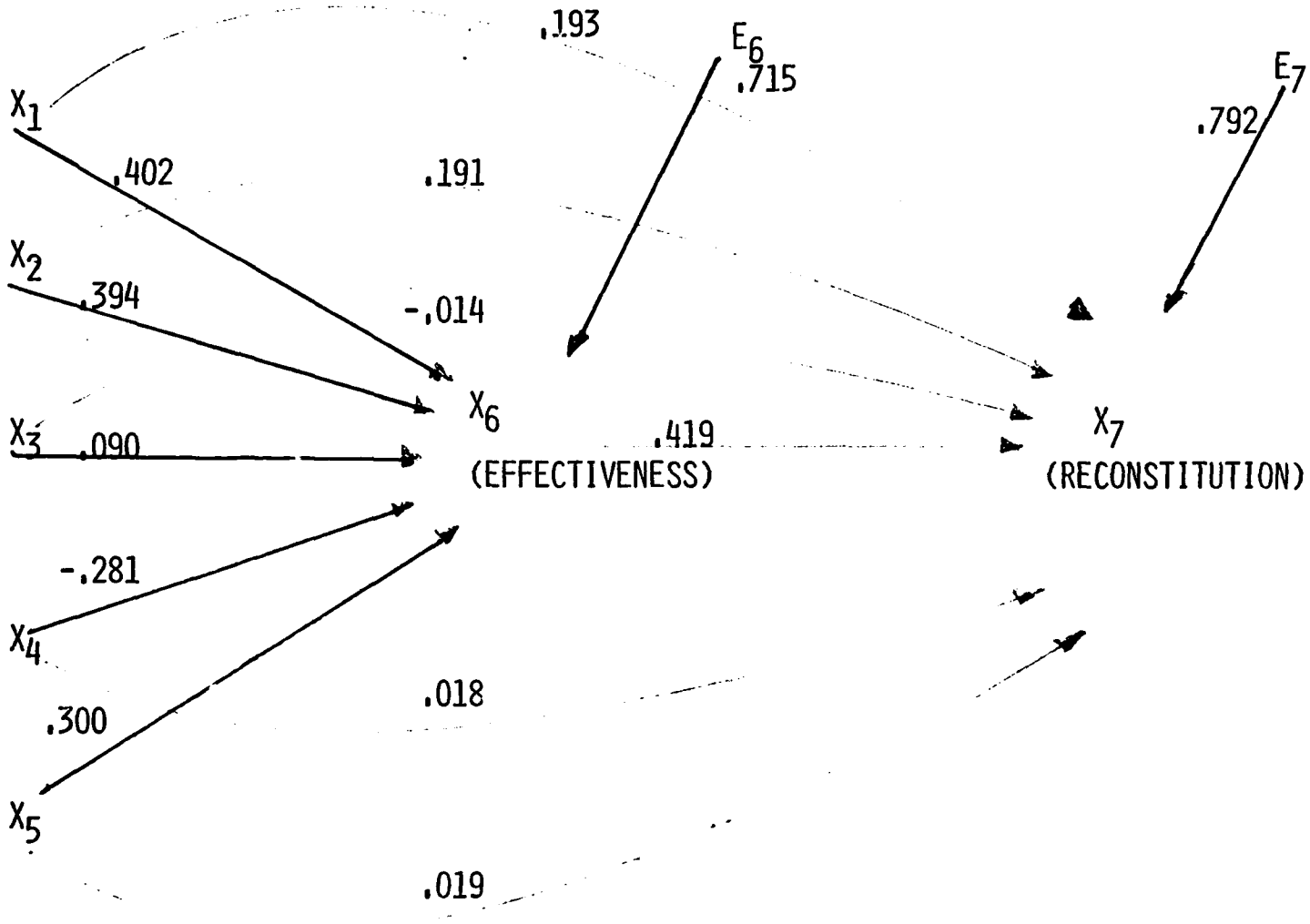

Figure C-14. Path coefficients for the reconstitution decision with all paths included, Armor School.

Table C-12. Direct and indirect effects of the five exogenous variables on the reconstitution decision, Armor School.

Variable	Direct	Indirect	Total
Personnel (X1)	.193	.168	.361
Equipment (X2)	.191	.165	.356
Combat Support (X3)	-.014	.038	.024
Enemy Situation (X4)	.018	-.118	-.100
Leadership/Troop Quality (X5)	.019	.126	.145

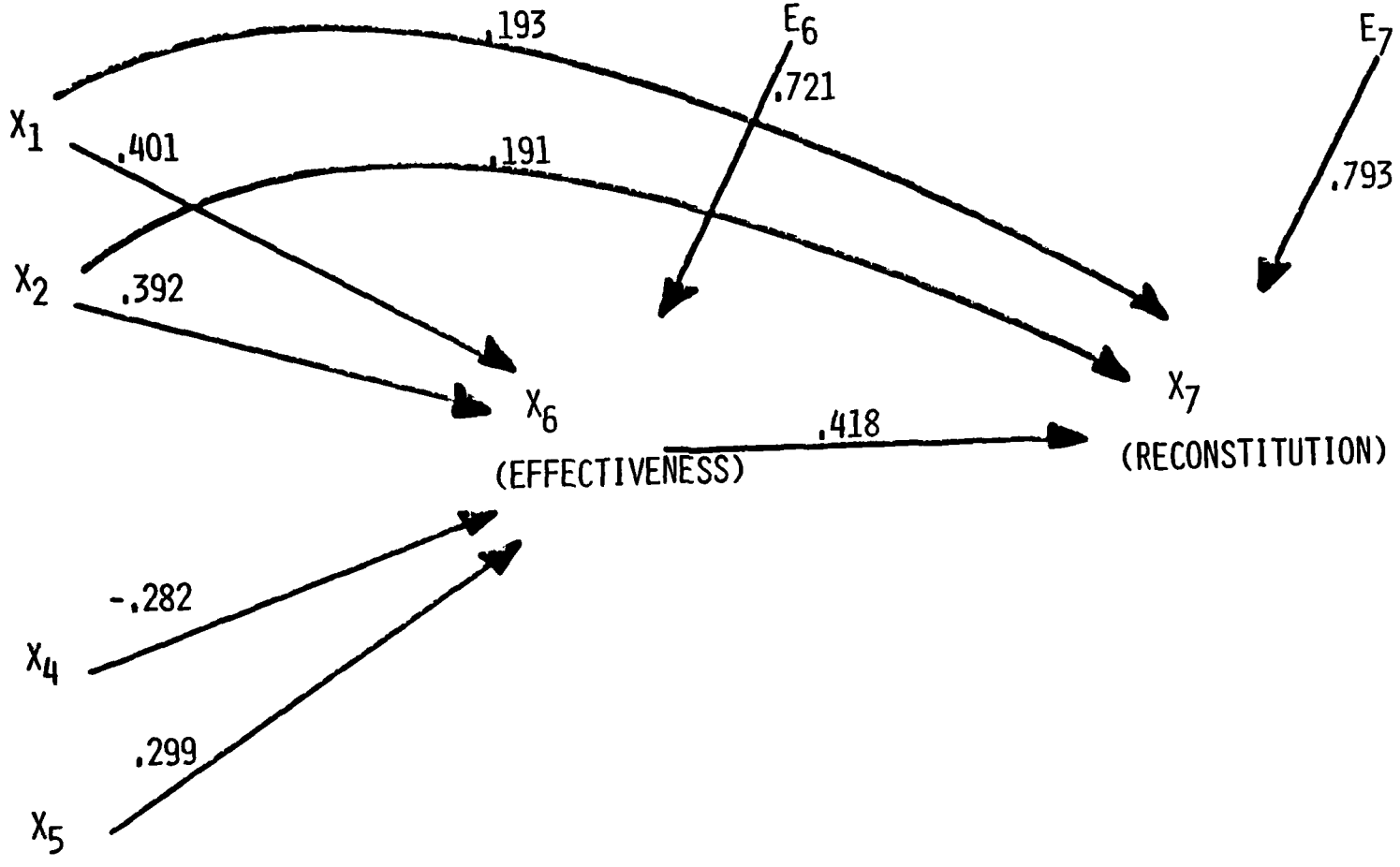

Figure C-15. Reduced causal model, Armor School.

Table C-13. Percent of respondents answering favorably to informational questions.

	Percent of Respondents Answering Favorably			
Question	AWC	CGSC	Infantry	Armor
Instructions	87	93	91	89
Scenario	79	83	86	88
Indicators	86	83	87	74
Information	79	79	83	76
Confidence	59	69	77	51

The intent of the extended analysis was not to use the junior officers as "experts" in the role of battalion commander but rather to provide a contrast or comparison of the perceptions of officers across a wide range of experience.

c. Descriptive Statistics.

(1) The four respondent groups did not differ markedly in their percentage of responses that reconstitution was needed (AWC - 39 percent, CGSC - 45 percent, Infantry - 36 percent, Armor - 45 percent). Mean effectiveness ratings were also similar, ranging from 5.17 to 5.64. Likewise, the four groups tended to use the entire effectiveness rating scale to the same extent, the range of the mean effectiveness rating for the highest ranking profile being 8.529 to 8.750 and for the lowest ranking profile being 1.967 to 2.250.

(2) The plots of the reconstitution decision versus effectiveness rating (figures 6-3, C-3, C-8, and C-13) display the same general characteristics for the four groups. An interesting insight can be developed by comparison of the plots for CGSC (figure 6-3) and AWC (figure C-3). CGSC respondents tended to decide that reconstitution was needed more often than the AWC respondents (45 percent versus 39 percent). This trend is apparent again in the plots where at the effectiveness level of 5, CGSC respondents decided that reconstitution was needed more often than not, whereas at the 5 level, AWC respondents decided more often that reconstitution was not needed. This has the effect of locating the greatest area of indecision for the CGSC respondents slightly to the right of that for AWC respondents on the effectiveness rating scale. Thus, the CGSC respondents demonstrated a tendency to decide that reconstitution is needed for units at a somewhat higher level of effectiveness potential than did the AWC respondents.

d. Path Analysis. Table C-14 provides a summary of the direct, indirect, and total effects of the five exogenous variables on the reconstitution decision for the four respondent groups. The causal modeling techniques used in this analysis do not support a comparison of the numerical values of the path coefficients across groups; e.g., a comparison of the direct effects values for the personnel variable among groups is not valid. However, comparisons of the relative strengths of the effects within the groups can be made.

(1) In looking at direct effects of the variables on the reconstitution decision, it can be seen that the AWC respondents gave greater weight to personnel relative to the other indicators than did the other groups. CGSC and Infantry School respondents gave greater weight to personnel status but were also influenced somewhat by equipment status. Interestingly, for the Armor School respondents, the direct effects of personnel and equipment were approximately equal. Direct effects for the other three variables were negligible for all four respondent groups. For the AWC respondents, the equipment status variable also exhibited negligible direct effect.

Table C-14. Summary of direct and indirect effects of the five exogenous variables on the reconstitution decision, all samples.

Variable	Direct				Indirect				Total			
	AWC	CGSC	Inf	Arm	AWC	CGSC	Inf	Arm	AWC	CGSC	Inf	Arm
Personnel	.336	.282	.260	.193	.223	.226	.192	.168	.559	.508	.452	.361
Equipment	.049	.149	.107	.191	.158	.174	.142	.165	.207	.329	.249	.356
Combat Support	-.024	-.001	-.023	-.014	.047	.034	.046	.038	.023	.033	.023	.024
Enemy Situation	.058	.063	.031	.018	-.129	-.124	-.121	-.118	-.071	-.061	-.090	-.100
Leadership/ Troop Quality	-.024	-.027	-.005	.019	.100	.128	.133	.126	.076	.101	.128	.145

(2) The summary of indirect effects indicates that all respondent groups were influenced at least somewhat by four of the five variables in relating unit effectiveness potential to the need for reconstitution, the combat support indicator having negligible indirect effect. Strength of the indirect effects were, in descending order, personnel, equipment, leadership/troop quality, and enemy situation for the CGSC and Advanced Course respondents. AWC respondents reversed the order of the enemy situation and leadership/troop quality.

(3) The totals for both direct and indirect effects reflect the dominance of the personnel status variable for all groups. The relative strengths of the total effects can be seen more clearly in table C-15. In this table, the personnel status indicator for each group is given a weight of 100, and the remaining total effects values are normalized to the personnel variable. In this way, the weight given by each group to each indicator relative to the weight that group gave to personnel can be seen. The table shows that the strength of the equipment status variable relative to personnel ranged from nearly equal (Armor School) to being less than half as influential (AWC). The leadership/troop quality variable ranged from a high of 40 relative to personnel (Armor School) to a low of 14 (AWC). The order of influence of the variables for all groups was: (1) personnel, (2) equipment, (3) leadership/troop quality, (4) enemy situation, and (5) combat support.

C-6 SUMMARY. The extended analysis demonstrated that the sampled populations responded to the reconstitution questionnaire in much the same way regardless of experience levels. Personnel status was the overriding consideration in determining whether the unit in the described situations needed to be reconstituted in order to continue to perform its mission. Equipment status was also a consideration, with leadership and troop quality and enemy situation exerting slight effects on the decision. The influence of combat support status on the reconstitution decision was negligible.

a. It seems obvious that all the respondent groups tended to think of reconstitution in terms of replenishment of personnel resources and that, in the much-simplified questionnaire profile situations, a low personnel status was indicative of a need for reconstitution. The other variables, which would be expected to mitigate that need in a real combat situation, apparently influenced the decisions of the respondents very little. It is problematic whether these results reflect the behavior that would be expected of the respondents in a battle situation or whether the questionnaire failed to elicit the fully reasoned decisions that it was designed to collect.

b. The extended analysis showed that both more senior and more junior officers exhibited the same tendency as the CGSC respondents to ignore combat support status in their evaluations. It was expected that the respondents would consider the availability of combat support as a resource that could, in some situations, enable the unit to continue its mission even after suffering

Table C-15. Total effects of the five exogenous variables on the reconstitution decision (normalized to personnel status variables).

Variable	AWC	CGSC	Inf	Arm
Personnel	100	100	100	100
Equipment	37	65	55	99
Combat Support	4	6	5	7
Enemy Situation	-13	-12	-20	-28
Leadership/Troop Quality	14	20	28	40

personnel attrition. Very few written comments addressed specifically the value of this indicator. Those that did so tended to be negative. The extent to which this result may indicate a typical or widespread perception of the officer respondents is unknown.

c. A somewhat different situation exists with respect to the leadership/troop quality indicator. This indicator showed negligible direct effects on the reconstitution decision for all respondent groups and only moderate indirect effects. Nevertheless, many respondent comments spoke to the importance of the components of this variable--leadership capability, commander personality, unit cohesion, etc. The impression persists that the respondents do consider the indicator important but either could not or chose not to evaluate the impact of these more abstract factors in the hypothetical situations.

d. The extended analysis results do not change the nature of the findings and conclusions of the original study as reported in chapter 7 of the Main Report. The consistency of the trends demonstrates that the questionnaire instrument elicited similar responses from all the officer groups sampled. The weaknesses of the analysis are those inherent to the application of analytical techniques to human decision processes. The study should be of value specifically to model developers as they attempt to incorporate, interactively or systemically, commander decisions relative to reconstitution operations. In a general sense, the study should contribute to an understanding of the issues involved in the development and instruction of doctrine for reconstitution of units in combat.

APPENDIX D

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