

AN ABSTRACT OF THE THESIS OF

STANLEY ROBERT THOMPSON for the MASTER OF SCIENCE  
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WITHIN A FRAMEWORK OF UNCERTAINTY

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Leon Garoian

A major problem confronting farmer cooperatives merging for the first time is the lack of valuable experience that a prior merger would have provided. This lack of experience results in a decision making environment of imperfect knowledge, both of the necessary postmerger activities to be performed and the timing of their performance. Thus, it was the purpose of this study to provide inexperienced cooperatives with a guide for scheduling uncertain postmerger decisions and activities. Such a guide will enable more rational postmerger decision making and more effective reorganization of merging businesses.

The additional information was provided primarily from the historical records of an actual dairy cooperative case merger to which a technique known as PERT (Program Evaluation and Review Technique) was applied to develop a prescriptive model of the

postmerger activities and their scheduling for possible use in similar subsequent mergers. The major benefits from using a case study approach was pedagogical in the hope that the results would be more readily adopted in practical use than if a purely theoretical design were used. Furthermore, the results of the study are based on the supposition that the synergistic benefits are greatest when the length of the postmerger decision period is minimized.

Uncertainty is alleviated through planning and PERT is a planning tool that can be used to minimize project completion time. However, by applying PERT to historical data much can be learned from the experience of a previous merger. The results of applying PERT to a posteriori case study data provided a prescriptive guide for scheduling postmerger decisions and activities. More specifically, PERT determined the key performance areas of marketing and personnel to be of critical significance following the decision to merge. These areas were determined to be critical with respect to their constituent activity completion times; that is, the sequential activity path determined to be the longest occurred within the marketing and personnel areas. Thus, the expected completion times of the activities within these areas must not be prolonged in order that the merger may be completed on schedule.

As determined by PERT, all other key performance areas in

the case merger were not likely to become bottleneck areas during the postmerger decision period; basically their integration responsibility was one of converting the premerger procedures of the "acquired" cooperatives to that of the acquiring cooperative.

Merging cooperatives can realize substantial savings from adapting the methods and findings of this study to their particular situation. Such a course of action will enable a more rapid completion of the postmerger decisions and activities and hasten the realization of the potential synergistic benefits.

Scheduling Cooperative Postmerger Decisions  
Within a Framework of Uncertainty

by

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Professor of Agricultural Economics  
in charge of major

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Head of the Department of Agricultural Economics

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Dean of Graduate School

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Typed by Velda D. Mullins for Stanley Robert Thompson

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SCHEDULING COOPERATIVE POSTMERGER  
DECISIONS WITHIN A FRAMEWORK  
OF UNCERTAINTY

I. INTRODUCTION

Since 1955, this country has witnessed an unprecedented growth in corporate mergers.<sup>1/</sup> During the decade 1955-1965, all but 14 of the 500 largest industrial firms were engaged in some type of merger activity (Loomis, 1966). In 1968, topping an upward trend, the total reached 4,000, an increase of 68% compared with 1967 (Stern, 1969).

Agricultural cooperatives are witnessing a similar reorganization movement. During the 1960-1964 period the number of cooperative mergers was 55 per year; approximately twice that of the previous five-year period. The total number of agricultural cooperatives during the period 1967-1968 was 7,940 compared to 8,125 the previous year, a decrease of 2%. The number of

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<sup>1/</sup> Merger, one method of external expansion, as used in this study is distinguished from other forms of external growth, viz., consolidation. A merger involves the acquisition of one firm by another, with only the acquiring firm retaining its identity. However, consolidation describes the situation where two or more previously independent concerns combine in such a manner that each loses its identity and a new organization is created. The term acquisition refers to the purchase of all or part of one firm by another.

cooperatives principally marketing farm products was 4,929 compared to 5,076 the previous year, and handling farm supplies as their principal business showed 2,835 associations compared to 2,871 the previous year. According to the Farmer Cooperative Service, this decrease reflects a continuing reorganization trend involving merger, consolidation, and acquisition (U. S. D. A., 1969a). For example, the 1,129 cooperatives handling dairy products in 1967-1968 was down from 1,209 the previous year, representing a decrease of 7% (U. S. D. A., 1969b). This continuing trend in cooperative growth is a consequence of the high expected payoff resulting from combining the functions of two or more cooperatives.

According to economic theory, the size of a firm can be increased via merger.<sup>2/</sup> Thus, as long as economies of scale are encountered, average per unit costs can be expected to decrease, resulting in an increase in profits or savings, ceteris paribus. Consequently, mergers may have synergistic effects, that is, the total profit or savings of the combined firms may be greater than the sum of the constituent parts. Synergy growth is described as

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<sup>2/</sup> Growth can occur either internally or externally. Internal growth refers to growth of a cooperative by constructing its own facilities, by increasing membership or business volume, or by developing its own markets. In contrast, external expansion refers to growth by merger, acquisition, or consolidation.

the two-plus-two equals five effect (Short, 1967).

Since the success or failure of unification is reflected in the degree of synergy obtained subsequent to merger, it is well to consider the question, does synergy, in fact, result from mergers, and more specifically, among agricultural cooperative mergers?

During the period 1893-1902, Dewing (1921) found that earnings of the constituent companies before merger were nearly a fifth greater than the earnings of the combined company for the first year after merger, and between a fifth and sixth greater than the average earnings of the ten years following the merger. Upon further analysis of Dewing's sample, Mead (1930) found that mergers were successful, reflecting the advantages of large scale operations. However, a study by Reid (1966) on the 1951-1961 merger period found that common stock prices of internal growth companies increased more than twice that of companies following active merger strategies. Finally, Kitching (1967) divided synergy into size and profit synergy, and concludes that the former is more certain and the latter more serendipitous.

More recently, Garoian and Cramer (1969a) have attempted to equate the ex ante objectives to the ex post results of agricultural cooperative mergers. All of the cooperatives in their study were motivated to grow by merger to attain economies of size; however, only 50% of the acquiring cooperatives achieved this

objective subsequent to merger. Also, most of the acquiring firms did not increase their rate of return after merger. These results parallel Kitching's findings. In contrast, all of the acquired cooperatives did achieve substantial economies of size and increased their rate of return to their members. Other objectives were achieved. Those cooperatives that merged to improve member patron services, to increase barriers to entry, to obtain additional facilities, or to diversify their facilities generally achieved their objectives (Garoyan and Cramer, 1969b).

Therefore, as the above results suggest, the existence of synergy for the acquiring firm is indeed questionable, and to a great extent is a function of the firm's objectives inasmuch as some objectives can only be achieved by expanding externally. However, many of the mergers that were not successful could have resulted from firms that resorted to merger only after all other alternatives had been exhausted and the firm was virtually bankrupt; it is likely that these firms may have been worse off had they not merged (Berry, 1968). Therefore, the existence of synergy depends upon the growth alternatives available, the objectives of the merger and, of course, the criterion of success.

The above evidence of merger performance of acquiring firms casts doubt on the widely held belief that merger always results in synergistic effects. Notwithstanding these dubious conclusions, the concept of synergy remains the primary goal in most unification

projects, despite the probability of success (on the average) of 50% or less.

In the cooperatives' quest for synergy many unforeseeable problems can arise; especially if the cooperatives are merging for the first time. Thus it is apparent that merging cooperatives need a guide to follow in order to achieve maximum effectiveness following the decision to merge.

A review of the literature reveals that there is a guide to assist farmer cooperatives using the consolidation route to growth (Wentzel, 1968a). However, there is no such guide available to assist cooperatives in scheduling their postmerger decisions and activities.

### The Problem

Pedagogically, projects can be classified as one of two types: programmed and nonprogrammed (Garoian and Haseley, 1965). Programmed projects rely on historical data for forward planning; whereas, nonprogrammed projects differ in that they are unique, having no historical reference. Therefore, management's task to plan, organize, direct and control nonprogrammed projects is much more difficult than for similar projects completed at least once before. With the nonprogrammed project, management cannot be guided by experience because, by definition, there

is no such experience with exactly the same variables or conditions.

The task of merging cooperatives can be classified as a non-programmed project. Consequently, cooperatives merging for the first time lack the experience that a prior merger would have provided. Without the knowledge of a prior merger, the reliance on inexperienced personnel during this uncertain situation can result in many costly decisions.

Therefore, in an attempt to lead cooperatives through the intricate maze of postmerger decision making, it is the purpose of this study to provide farmer cooperatives with a guide for scheduling uncertain postmerger decisions and activities. In doing so, merging cooperatives will have available improved information to enable more rational postmerger performance.

This study is based on the supposition that time is a critical factor in the cooperative's quest for synergy; generally the sooner the synergistic benefits can be realized the better. It is further assumed that the benefits of synergy are greatest when the time involved in completing the postmerger activities is kept at a minimum. Also, the element of time is important with regard to holding the period of uncertainty to a minimum. Given a choice, most managers are assumed to prefer a condition of certainty rather than one of uncertainty. Furthermore, they want to know exactly which decisions should be made and when. This period of

indecision cannot be avoided; however, it should be kept as short as possible (Stevenson, 1968).

### Objectives

The primary objective of this study is to provide a prescriptive guide to aid farmer cooperatives in scheduling the proper sequence of decisions and activities required during the postmerger stage of their unification projects. In an attempt to provide cooperatives with such a guide, the PERT technique is employed. With the application of PERT to specific case study data, the following sub-objectives are established:

- (1) Identify the nonrecurrent activities and events subsequent to the decision to merge.
- (2) Diagrammatically depict in a descriptive network the interrelationships and dependencies among the activities and events in the case merger.
- (3) Obtain estimated completion times for each of the identified activities.
- (4) Diagrammatically depict in a prescriptive network the interrelationships among the activities as a guide in similar subsequent mergers.
- (5) Through the application of PERT, determine the critical activity path among activities in the prescriptive network.

- (6) Interpret the results of the PERT technique.

### The Analytical Tool--PERT

In 1958 a new management planning and control technique was developed, commonly referred to as PERT (Program Evaluation and Review Technique). PERT serves as a manager's tool for defining and coordinating what must be done to successfully accomplish the objectives of a project on time. Thus, it is a scheduling and control tool.

The PERT technique begins by the identification of events and activities which must be performed between the start and completion of a given project.<sup>3/</sup> Next, these activities and events must be organized into a network showing their sequence of accomplishments, interdependencies and interrelationships. Network construction is necessary in both descriptive and prescriptive cases, however, only in the prescriptive case is the PERT technique employed; the descriptive case consists only of the network.<sup>4/</sup> Moreover, network

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<sup>3/</sup> A PERT event represents the start or completion of a task. An event does not consume time or resources. In contrast, a PERT activity is the actual performance of a task. An activity is the time consuming portion of the PERT network and requires manpower, facilities or other resources.

<sup>4/</sup> Both descriptive and prescriptive networks are presented in Chapter IV.

construction forces the manager to organize and show the interdependencies and interrelationships among project activities.

Perhaps the major value in network construction is that the kind of planning required to create a valid network represents a major contribution to the ultimate successful control over a non-programmed project (Miller, 1962). Thus, explication is the major value of network construction.

Time estimates are then made for each activity of the network on a three-way basis; optimistic (a), most likely (m), and pessimistic (b) elapsed-time figures are estimated by the person or persons most familiar with each of the activities. The three estimates are required as a gauge of the "measure of uncertainty" for each activity.

We may conclude, therefore, that the wider the separation between the optimistic and pessimistic estimates (range of distribution), the greater the uncertainty associated with the activity.

(Federal Electric Corporation, 1963, p. 65)

From the three time estimates a statistical elapsed time ( $t_e$ ) can be derived,

where:  $t_e = \frac{a + 4(m) + b}{6}$  serves as the basis for estimating the expected value of the activity performance.<sup>5/</sup>

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<sup>5/</sup> The formula for ( $t_e$ ) is based on the assumption that the probabilistic density function of the beta distribution  $f(t) = K(t - a) \alpha (b - t) \gamma$  is an adequate model of the distribution of an activity time.

and:         $a$  = the optimistic time estimate  
                $m$  = the most likely time estimate  
                $b$  = the pessimistic time estimate  
                $t_e$  = a statistical mean or the average time the activity  
                       would take if it were repeated many times.

Subsequent to network construction and the assessment of the time estimates, the next step of the PERT technique is the establishment of the expected time each event can be reached in the network. These expected times are represented by the symbol ( $T_E$ ) and appear above each event in the prescriptive network. These are established by summing the  $t_e$ 's along any given path.

Next, the latest allowable completion time ( $T_L$ ) for each event is determined. By definition, ( $T_L$ ) is the latest time by which an event must be completed in order to keep the project on schedule. The  $T_L$ 's are computed in exactly the opposite manner the  $T_E$ 's were computed, that is, subtract the value of the  $t_e$  from the value of the  $T_L$  for the successor event.

Logically the difference between the earliest expected completion date ( $T_E$ ) and the latest allowable completion date ( $T_L$ ) represents slack; the slack of an event is  $T_L - T_E$ . The slack of an event is a measure of the excess time (resources) available in reaching an event. Moreover, the value of slack associated with an event determines how critical that event may become; the

smaller the slack, the more critical the event. Hence the critical path is the path with minimum slack.

In conclusion, the PERT technique can be used as a tool to provide additional information to the complex task of scheduling and controlling a unification project. While it may never prove to be a panacea to the uncertainty of the postmerger decision process, it would be valuable for managers to understand its principles and place in the application of modern decision theory.

### Methodology

In the attempt to achieve the objectives of this paper, the case study method was used to obtain the information necessary to construct the PERT network and to determine the critical path. Perhaps the most significant attribute of the case study approach lies in its ability to introduce realism into a formal presentation. Hopefully, by using the case study approach the results will be more readily adaptable in practical use than if a purely theoretical design were used. Moreover, this approach should result in wider acceptance and utilization by cooperatives confronted with similar postmerger problems.

Both primary and secondary data were collected for analysis. The former were obtained by in-depth interviews with individuals (e. g., accountants, attorney, management personnel, et. al.)

knowledgeable in the various functional areas of concern in the case illustration. The latter data were obtained from the historical records of the cooperatives participating in the merger (e. g., financial statements, correspondence, merger feasibility study, etc.).

Finally, the analytical technique of PERT was used to provide a definitive explication of the postmerger activities performed in the case merger. Furthermore, PERT reveals the critical path, that is, the activity sequence expected to take the longest. In so doing, the expected completion date of merger is determined, and adjustments in personnel and resource commitments can be made to avoid problems of scheduling within a desired time framework.

#### Limitations of the Study

Since each cooperative merger is conducted under unique conditions, it is impossible to present a complete list of details for handling postmerger decisions to fit all cases, nor is there any established order for presenting them. However, it is hoped that by the use of an actual case, decisions can be modified to fit the special conditions surrounding each merger.

A developmental case study will help other cooperatives to become aware of the complicated network of activities and the high degree of uncertainty which enters the process of postmerger

decision making. Typically in a case study, the particular development of the problem including the solution, if any, is not held up as an example of how people or organizations should behave. A case study is a sample of experience: good, bad, or indifferent (Heller, 1960).

### Plan of Development

In Chapter II a framework for decision making under conditions of imperfect knowledge is presented. In this chapter a basic foundation and orientation to modern decision theory is presented showing its relationship to the PERT technique.

In Chapter III the setting of the case merger is set forth. Chapter IV consists of three sections: first, the postmerger events of the case merger are depicted in a descriptive network; second, a detailed description of the actual procedure taken by the case merger in performing their postmerger decisions and activities is presented; and third, on the basis of the case merger, a guide for scheduling postmerger activities is presented by employing the PERT technique. In Chapter V a view of activity scheduling in perspective is presented from a normative viewpoint. Finally, in Chapter VI a summary is made of the study and conclusions are stated with respect to the findings.

## II. A FRAMEWORK FOR DECISION MAKING

Managers have used PERT (Program Evaluation and Review Technique) to cope with the uncertainty associated with the determination of project completion time. In the previous chapter these projects have been classified as nonprogrammed. Such projects are, by definition, always conducted under conditions of imperfect knowledge.

Traditionally, the nonprogrammed decision process has been more artistic than scientific. Those responsible for making these decisions have almost exclusively relied on subjective judgment, intuition, and rules of thumb (King, 1968). Assuming that decision makers are constantly striving to achieve rational decisions, subjective judgment, intuition, and rules of thumb do play a role in the decision process. Furthermore, subjective judgment precedes, but does not replace, the rational part of the decision process.

Since PERT is a technique that is based on the presentation of statistical information faced in completing the many activities associated with a project, its relationship to the decision maker's responsibility can be presented more meaningfully in terms of a basic decision theory foundation and orientation. Thus, the objectives of this chapter are two-fold: first, to pedagogically show how decision problems can be formulated in a manner that permits a

rational and systematic approach to their decision; and secondly, to show the relationship of the PERT technique to the decision theory framework.

### Decision Theory Approach

Solving a decision problem consists of selecting among alternative courses of action that particular action which will maximize the decision maker's total expected relative utility. Moreover, the purpose of decision theory is to provide a systematic approach to decision making under conditions of imperfect knowledge. By this is meant a formal analysis of decision alternatives when certain knowledge about reality is not known with certainty. Usually the consequences of the decision are well understood; only the "true state of nature" is unknown.

The desire to obtain knowledge of this state is considered the objective of the decision maker. In his attempt to achieve his objective, the decision maker has various possible actions (A) available to him. The choice among these actions is difficult because the consequences of choosing each action depend on certain conditions which cannot be predicted with certainty. These conditions are termed states of nature ( $\theta$ ). All relevant states of nature should be included in the analysis of the decision. However, in reality this can never be obtained, so a complete maximization is

not feasible (Buzzell and Slater, 1962a).

Assuming that a given action is selected and a given state of nature exists, it is possible to determine the payoff to the decision maker. The selection of a strategy and the occurrence of a state of nature will yield the decision maker a certain utility (U) in terms of his objectives. Therefore, what is needed is a measurement of utility reflecting the particular values of the decision maker.

The use of utility as a criterion for choosing among uncertain outcomes dates back to a paper by Bernoulli in about 1730 (Miller and Starr, 1960). Until recently, however, economists have tended to talk about utility rather than to measure it empirically. What little desire there was to measure utility slackened after it was demonstrated that indifference curve analysis based on ordinal ranking of preferences was sufficient to sustain the theory of riskless choice (Hicks and Allen, 1934). Hence, much of the economic theory of consumer behavior could be derived without a measurable concept of utility.

Recently, interest in the measurement of utility stems from von Neumann and Morgenstern (1947). In short, von Neumann and Morgenstern have shown that if a person can express his preferences from among choices of the action and state pairs where the pairs are selected from some basic set of alternatives, then utility associations can be introduced to the basic alternatives. In such a

situation, if the person is guided solely by the utility expected value, he is acting in accord with his true tastes; provided only that there is an element of consistency in his tastes (Luce and Raiffa, 1957a).

The criterion presented in this chapter for selecting an action is the maximum expected value of utility. While the objective of the decision maker can be the maximization of net profit or minimization of loss, this in fact may not be identical to the maximization of utility. The utility payoff depends on the decision maker's utility function (Schlaifer, 1959).

The prerequisite of using the maximization of utility criterion for an individual decision maker is that his utility function is known. It can be argued that since we are concerned with cooperatives, a group utility function is required. However any decision maker, either human being or organization, which can be thought of as having a unitary interest motivating its decisions can be treated as an individual in theory. If there are conflicts of interest among the individuals then they must be resolved or the organization must be considered as a group (Luce and Raiffa, 1957b).

Halter (1969a) provides an example that will explicate the criterion of maximization of utility. Consider the following payoff matrix characterized by  $(A, \theta, U, P)$ :

Table 1. Hypothetical Monetary Payoff Matrix.

States of nature	Actions		$P(\theta_i)$
	$A_1$	$A_2$	
$\theta_1$	0	\$10,000	1/2
$\theta_2$	0	-\$10,000	1/2
Expected value	0	0	

When the expected monetary gain is the choice criterion, the decision maker would be indifferent between  $A_1$  and  $A_2$ . More realistically, however, most would not be indifferent, particularly if a \$10,000 gain or loss were large in relation to present wealth. Thus the monetary criterion would not accurately measure the real consequences.

Since the monetary criterion would not provide an adequate measurement, a function must be derived relating monetary values to utility.

Assume the following utility function: (The shape of this particular function portrays a risk averter being prepared to take only gambles of more than fair odds)

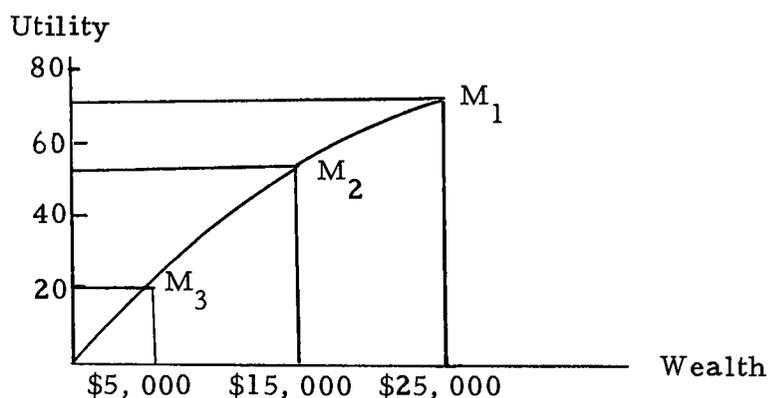


Figure 1. Hypothetical utility function.

Suppose the decision maker's initial wealth is \$15,000 at point  $M_2$ . If action  $A_1$  was executed he would remain at point  $M_2$ . However, if he chose action  $A_2$  he could be at point  $M_1$  with a \$10,000 increase in wealth with probability  $1/2$ , or he could be at point  $M_3$  with a decrease of \$10,000 in wealth with probability  $1/2$ . The decision maker's utility at points  $M_1$ ,  $M_2$ ,  $M_3$  are 70, 55, and 20, respectively. If the monetary payoff matrix is converted to a utility matrix the following payoff matrix results.

Table 2. Hypothetical Utility Payoff Matrix.

States of nature	Actions		P( $\theta$ )
	$A_1$	$A_2$	
$\theta_1$	55	70	$1/2$
$\theta_2$	55	20	$1/2$
Expected value	55	45	

Now the expected value for  $A_1$  is 55 and for  $A_2$  is 45.

Therefore, given this particular utility function the decision maker would choose  $A_1$ . Bear in mind, however, that utility functions can take different forms for different individuals with each form yielding a different value. Therefore the maximization of utility criterion can indeed yield a different result than the maximization of expected monetary value, and the same result if a linear utility function is assumed. The difference lies in the shape of the decision maker's utility function.

### Decision Theory Applied

For purposes of exposition an example has been developed consisting of three possible actions and three possible states of nature. And for simplicity, the decision maker's utility function is assumed to be linear. In other words, if a linear utility function is assumed the monetary payoffs are identical to the payoffs measured in terms of utility; the criterion of maximizing monetary value is identical to the criterion of maximization of utility. Thus, the decision maker's objective in the following example is minimization of loss, which simultaneously satisfies the criterion of maximization of utility.

Suppose an agricultural cooperative is contemplating merger with a few interested cooperatives and the cooperatives are

presently proceeding through the unification process. First, preliminary discussions are conducted among the interested firms. Secondly, a steering committee is established to arrange for and review the feasibility study. Third, if the feasibility study provides for substantial gains from merger and is favorably considered by the steering committee, then an attorney is consulted to develop the plan of merger. Next, the plan of merger is presented to the board of directors of each participating cooperative and approved. Next the membership of each cooperative votes on approval. If the membership approves the plan of merger the attorney proceeds to develop the articles of merger. Finally, the articles are filed and the merger becomes legally effective. At this stage, a major problem facing the surviving firm is centered on the time involved in combining the merged firms in such a manner that they operate effectively as one cooperative. Time is the critical factor and a rapid unification is desired in their quest of synergy.

The steering committee or a selected individual (decision maker) is confronted with the task of coordinating the completion of the postmerger decisions within a minimum time period. If the decision maker had a priori knowledge of the activities which are critical to the completion of the merger, sufficient resources could be allocated in such a manner as to provide for the minimum time completion and simultaneously minimize the decision maker's

expected loss. However, the decision maker does not have a priori knowledge on the states of nature, consequently the problem is solved under conditions of imperfect knowledge. The decision theory approach is adopted to arrive at a solution.

Suppose the general manager has three possible actions:

$A_1$  = allocate sufficient resources to complete the merger in 10 months.

$A_2$  = allocate sufficient resources to complete the merger in 12 months.

$A_3$  = allocate sufficient resources to complete the merger in 14 months.

His choice among the above actions depends on three states of nature:

$\theta_1$  = the actual duration of the postmerger decisions is 10 months.

$\theta_2$  = the actual duration of the postmerger decisions is 12 months.

$\theta_3$  = the actual duration of the postmerger decisions is 14 months.

Table 3 presents a tabulation of the losses incurred by taking a particular action given the occurrence of a particular state of nature:

Table 3. Loss Matrix  $L(\theta, A)$ .

States of nature	Actions		
	$A_1$	$A_2$	$A_3$
$\theta_1$	$L(\theta_1, A_1) = \$10,000$	$L(\theta_1, A_2) = \$20,000$	$L(\theta_1, A_3) = \$30,000$
$\theta_2$	$L(\theta_2, A_1) = \$50,000$	$L(\theta_2, A_2) = \$15,000$	$L(\theta_2, A_3) = \$25,000$
$\theta_3$	$L(\theta_3, A_1) = \$70,000$	$L(\theta_3, A_2) = \$60,000$	$L(\theta_3, A_3) = \$20,000$

Depending upon the knowledge available on the occurrence of the particular states of nature, one of three classes of decision problems will describe the situation.

### Three Classes of Decision Problems<sup>6/</sup>

#### Decision Problems With No Prior Distribution

This type of decision problem is characterized by complete uncertainty of the probability distribution on the states of nature. In actuality, however, this situation is virtually nonexistent. The decision maker always has the alternative of assigning a subjective probability distribution to the states of nature. Despite this

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<sup>6/</sup> These problems are discussed further in Halter, Chapter IV; and Luce and Raiffa, Chapter XIII.

situation's nonexistence, it is presented here only as a means of conceptualizing the decision problem. In general this problem is characterized by three parameters (A,  $\theta$ , U). The following criteria have been proposed to solve the decision problem under complete uncertainty.

Criterion of Rationality (Laplace Principle of Insufficient Reason)

Under this criterion the assumption is that the "best" payoff (minimum loss) will occur. The expected value for each action is calculated with each state of nature equally likely to occur (i. e.,  $P = 1/3$ ), and the "best" action (minimum loss) is chosen. The expected values are calculated using the following formula:

$$\text{Expected value} = L_1 P_1 + L_2 P_2 + L_3 P_3,$$

where the L's are the possible losses from the loss matrix and the P's represent the probability that each of the L's will occur.

The expected values are:

<u>Action</u>	<u>Expected value (loss)</u>
A <sub>1</sub>	\$43, 333
A <sub>2</sub>	\$31, 667
A <sub>3</sub>	\$25, 000

Under this criterion the decision maker would choose action A<sub>3</sub> since this would minimize his loss.

Criterion of Pessimism (Maximin)

Under this criterion the assumption is that the "worst" payoff (maximum loss) will occur; then the "best" (minimum loss) is chosen.

<u>Action</u>	<u>"Worst" (maximum loss)</u>
A <sub>1</sub>	\$70, 000
A <sub>2</sub>	\$60, 000
A <sub>3</sub>	\$30, 000

If the criterion of pessimism was selected, the decision maker would choose action A<sub>3</sub>.

Criterion of Optimism (Maximax)

The criterion of optimism involves choosing the action that gives the "best" possible (minimum cost) outcome.

<u>Action</u>	<u>"Best" (minimum loss)</u>
A <sub>1</sub>	\$10, 000
A <sub>2</sub>	\$15, 000
A <sub>3</sub>	\$20, 000

In this example the best possible outcome would be A<sub>1</sub>.

### Criterion of the Optimum-pessimism Index

This criterion requires that the decision maker be evaluated (either by himself or peer) in terms of his degree of optimism. Suppose that he is given an index of .60. This means that on the average he acts like an optimist 60% of the time and as a pessimist 40% of the time. To evaluate the expected value of any action taken, multiply .60 times the best possible (minimum loss) outcome and add this value to .40 times the worst possible (maximum loss) outcome for the action.

<u>Action</u>	<u>Expected Value (loss)</u>
A <sub>1</sub>	\$34,000
A <sub>2</sub>	\$33,000
A <sub>3</sub>	\$24,000

With this criterion the best action would be A<sub>3</sub>.

### Criterion of Regret (minimax)

The criterion of regret requires the construction of a regret matrix. The following matrix is derived from Table 3 by subtracting each cost from the least cost possible for each state of nature. It represents the regret that the decision maker feels under each state of nature if he made a less than optimum decision.

Table 4. Regret Matrix  $R(\theta, A)$ \*

States of nature	Actions		
	$A_1$	$A_2$	$A_3$
$\theta_1$	0	10,000	20,000
$\theta_2$	35,000	0	10,000
$\theta_3$	50,000	40,000	0

\*  $R(\theta, A) = L(\theta, A) =$  minimum loss for that value of  $\theta$ .

<u>Action</u>	<u>Greatest regret</u>
$A_1$	\$50,000
$A_2$	\$40,000
$A_3$	\$20,000

The decision maker should choose action  $A_3$ .

#### Criterion Equivalent to Expressing Subjective Probability

It can be argued that any decision making problem under complete uncertainty can be viewed as having a probability distribution on the states of nature, that is, subjective probabilities can always be assigned by the decision maker. The solution is then found by maximizing the expected value. This criterion is characterized by the parameters  $(A, \theta, U, P)$ , where  $P$  is the subjectively assigned probability distribution.

Decision Problems With a Prior Distribution

Decision problems with a prior probability distribution are characterized by the decision maker either having partial or complete knowledge about the probability distribution on the states of nature (Halter, 1969b). This a priori distribution is usually in the form of historical data, or past experience on the occurrence of the states of nature. This problem is characterized by the parameters (A,  $\theta$ , U, P).

In the example, suppose the decision maker has available historical data on other previous cooperative mergers. He then assigns a probability, based on the historical data, to the occurrence of each state of nature. This is the a priori distribution and is denoted by  $P(\theta_i)$ . It is known before an observation is made.

$$P(\theta_1) = .20$$

$$P(\theta_2) = .50$$

$$P(\theta_3) = .30$$

The expected values are calculated for each action utilizing the a priori distribution.

<u>Action</u>	<u>Expected value (loss)</u>
A <sub>1</sub>	\$48,000
A <sub>2</sub>	\$25,000
A <sub>3</sub>	\$50,000

Based on the a priori distribution, the decision maker would choose  $A_2$ .

### Decision Problems with Posterior Distribution

This type of decision problem is characterized by the possibility of obtaining additional information on the occurrence of the states of nature before the decision is rendered (Halter, 1969c). This problem is characterized by the parameters  $(A, \theta, U, P, Z)$ , where  $Z$  represents an experiment or indicator (e. g., PERT technique) for obtaining additional evidence on the likelihood of the states of nature.

Suppose, in the example, the decision maker has available to him additional information to improve the a priori distribution. This information is provided by an indicator or experiment which determines the critical path via PERT technique. The following is the outcome of this experiment:

$Z_1$  = PERT indicates a critical path of 9 months.

$Z_2$  = PERT indicates a critical path of 13 months.

$Z_3$  = PERT indicates a critical path of 15 months.

The accuracy of the above predictions can be given in a table of frequency responses (see Table 5). The frequency response table portrays an evaluation of the accuracy of past PERT results

using the concept of conditional probability, i. e.,  $P(Z | \theta)$ . This probability is the likelihood of the occurrence of the PERT results, given the actual occurrence of a state of nature.

Table 5. Frequency Responses  $P(Z | \theta)$ .

States of nature	Responses			Total
	$Z_1$	$Z_2$	$Z_3$	
$\theta_1$	$P(Z_1   \theta_1) = .80$	$P(Z_2   \theta_1) = .20$	$P(Z_3   \theta_1) = .00$	1.0
$\theta_2$	$P(Z_1   \theta_2) = .25$	$P(Z_2   \theta_2) = .50$	$P(Z_3   \theta_2) = .25$	1.0
$\theta_3$	$P(Z_1   \theta_3) = .00$	$P(Z_2   \theta_3) = .40$	$P(Z_3   \theta_3) = .60$	1.0

The problem, however, is to find the expected probability distribution for  $\theta$  given the prediction  $Z$  is made before the decision is rendered. Using the a priori distribution together with the conditional probability distribution  $P(Z | \theta)$ , it is possible to calculate the  $P(\theta | Z)$ . The  $P(\theta | Z)$  is called the a posteriori distribution of states of nature since it is the distribution after the observations have been made. The a posteriori probabilities are calculated using Bayes theorem:

$$P(\theta | Z) = P(\theta) \frac{P(Z | \theta)}{P(Z)}$$

This can be conveniently done by means of Table 6.

The numbers in the lower section of Table 6 are the probability

Table 6. Calculation Table for  $P(\theta|Z)$ .

P(Z  $\theta$ )			P( $\theta$ )	P( $\theta$ )·P(Z  $\theta$ )			
Z <sub>1</sub>	Z <sub>2</sub>	Z <sub>3</sub>		Z <sub>1</sub>	Z <sub>2</sub>	Z <sub>3</sub>	
$\theta_1$ P(Z <sub>1</sub>   $\theta_1$ )=.80	P(Z <sub>2</sub>   $\theta_1$ )=.20	P(Z <sub>3</sub>   $\theta_1$ )=.00	P( $\theta_1$ )=.20	P( $\theta_1$ )·P(Z <sub>1</sub>   $\theta_1$ )=.160	P( $\theta_1$ )·P(Z <sub>2</sub>   $\theta_1$ )=.040	P( $\theta_1$ )·P(Z <sub>3</sub>   $\theta_1$ )=.000	
$\theta_2$ P(Z <sub>1</sub>   $\theta_2$ )=.25	P(Z <sub>3</sub>   $\theta_2$ )=.50	P(Z <sub>3</sub>   $\theta_2$ )=.50	P( $\theta_2$ )=.50	P( $\theta_2$ )·P(Z <sub>1</sub>   $\theta_2$ )=.125	P( $\theta_2$ )·P(Z <sub>2</sub>   $\theta_2$ )=.250	P( $\theta_2$ )·P(Z <sub>3</sub>   $\theta_2$ )=.125	
$\theta_3$ P(Z <sub>1</sub>   $\theta_3$ )=.00	P(Z <sub>2</sub>   $\theta_3$ )=.40	P(Z <sub>3</sub>   $\theta_3$ )=.60	P( $\theta_3$ )=.30	P( $\theta_3$ )·P(Z <sub>1</sub>   $\theta_3$ )=.000	P( $\theta_3$ )·P(Z <sub>2</sub>   $\theta_3$ )=.120	P( $\theta_3$ )·P(Z <sub>3</sub>   $\theta_3$ )=.180	
P(Z)*				.285	.410	.305	
*P(Z) is the sum of the Z values in each column.			P( $\theta Z$ )	$\theta_1$	$\frac{P(\theta_1) \cdot P(Z_1 \theta_1)}{P(Z_1)} = .56$	$\frac{P(\theta_1) \cdot P(Z_2 \theta_1)}{P(Z_2)} = .10$	$\frac{P(\theta_1) \cdot P(Z_3 \theta_1)}{P(Z_3)} = .00$
				$\theta_2$	$\frac{P(\theta_2) \cdot P(Z_1 \theta_2)}{P(Z_1)} = .44$	$\frac{P(\theta_2) \cdot P(Z_2 \theta_2)}{P(Z_2)} = .61$	$\frac{P(\theta_2) \cdot P(Z_3 \theta_2)}{P(Z_3)} = .41$
				$\theta_3$	$\frac{P(\theta_3) \cdot P(Z_1 \theta_3)}{P(Z_1)} = .00$	$\frac{P(\theta_3) \cdot P(Z_2 \theta_3)}{P(Z_2)} = .29$	$\frac{P(\theta_3) \cdot P(Z_3 \theta_3)}{P(Z_3)} = .59$

distributions over the states of nature, given any  $Z$  before the decision is rendered.

<u>If <math>Z_1</math> is observed</u>		<u>If <math>Z_2</math> is observed</u>		<u>If <math>Z_3</math> is observed</u>	
<u>Action</u>	<u>Expected value (loss)</u>	<u>Action</u>	<u>Expected value (loss)</u>	<u>Action</u>	<u>Expected value (loss)</u>
$A_1$	\$27,600	$A_1$	\$51,800	$A_1$	\$61,800
$A_2$	\$13,800	$A_2$	\$28,550	$A_2$	\$41,550
$A_3$	\$17,800	$A_3$	\$24,050	$A_3$	\$22,050

Using the Bayesian strategy:

When  $Z_1$  is indicated, follow  $A_2$ .

When  $Z_2$  is indicated, follow  $A_3$ .

When  $Z_3$  is indicated, follow  $A_3$ .

### The Relationship of the PERT Technique to the Decision Theory Framework.

The relationship of the PERT technique to modern decision theory may be explained as follows. PERT can significantly enhance the results of the formal decision process by providing the decision maker with improved information on the occurrence of the states of nature. The very task of network construction showing the interrelationship among the activities can provide the decision maker with a more objective basis for assigning probabilities to the various states of nature. Also, the determination of the critical

path can provide the decision maker with additional information (represented by the Z's in the example) to improve the a priori probability distribution; thus enabling Bayesian analysis.

The critical point, however, is that PERT does not make decisions; it is only a tool that can be used as an indicator to provide the decision maker with additional information to enable him to make a more rational decision.

In summary, the primary difference between the decision theory approach and traditional decision making is the formalization of the intuitive process of choosing among alternatives as illustrated by the following:

While this [decision theory] may or may not improve the judgment of the individual decision maker, it improves his communication with others and facilitates the collection and analysis of further information. More importantly, it forces the executive to examine his problem in concrete terms, and thus serves as a stimulus for more systematic thinking on his part. (Buzzell and Slater, 1962b, p. 16)

Furthermore, since PERT is concerned with nonprogrammed projects which are, by definition, conducted under conditions of imperfect knowledge, it is hoped that the presentation of the decision theory approach will provide a theoretical framework for solving problems of imperfect knowledge.

### III. A CHRONICLE OF THE CASE MERGER

On January 1, 1967, three Oregon and one Washington dairy marketing cooperatives were merged into Mayflower Farms of Portland, Oregon. The merger was consummated after five years of premerger discussions and extensive educational efforts from a group of professional advisors. The latter provided experience as well as confidence which an inexperienced firm often lacks during such an uncertain decision period.

As the result of favorable premerger discussions among the interested cooperative firms, the arrangement was made to conduct a merger feasibility study. Consequently, in 1965, a feasibility study was completed by a team of agricultural economists. This study was concerned with seven firms that indicated a desire to merge.

Subsequent to the completion of the feasibility study, three of the original seven cooperatives lost interest in the proposed unification project, but one additional cooperative indicated a desire to be included in the project; remaining were five cooperatives interested in merger.

At the request of the advising attorney, the five cooperatives still participating in the preliminary discussions were asked to submit a "Letter of Intent" whereby the board of directors of each

constituent cooperative registered its willingness to be considered in the plan of merger.

Approximately one year after the initial feasibility study involving the seven cooperatives, and immediately after the "Letters of Intent" were received, a different team of agricultural economists from Oregon State University conducted a second merger feasibility study encompassing only those five remaining participants from the preliminary discussions. After the completion of the second feasibility study, the plan of merger was submitted to the boards and with their approval, to members of the five cooperatives. The members gave their approval to merger in October, 1966. However, the legally effective date came at the end of the fiscal year when the articles of merger were filed with the corporate commissioner of the State of Oregon.

On January 1, 1970, the postmerger decisions and activities were completed, three years subsequent to the decision to merge. This lengthy time period was primarily due to the cooperatives' inexperience in making postmerger decisions, and the complexities involved in integrating policies and procedures of five firms-- both of which contributed to a great deal of uncertainty.

### Premerger Organization and Operational Structure

The case unification was a horizontal merger which is, by definition, an integration of firms performing similar functions.

At the time of the merger the surviving cooperative was producing a "full-line" of dairy products. With respect to the merging cooperatives, three maintained a "full-line" of dairy products and one operated only as a receiving station while leasing its processing facilities to another firm.

The geographical locations of the five cooperatives are widely separated; that is, if an individual were to drive round-trip among all of the branches he would have traveled approximately 1,700 miles. Geographic location of the merging firms can have a significant effect on long range plans and should be considered with respect to its consistency with market projections and the long-run goals of the combined cooperative. Wide geographic dispersion can have undesirable ramifications, particularly as in the case situation, with regard to postmerger coordination.

### The Feasibility Study

The original feasibility study was conducted by three out-of-state agricultural economists with assistance from the agricultural economics staff of Oregon State University; the second study was

conducted by Oregon State University agricultural economists. Both studies were concerned with increasing producer returns through increased efficiency and cost reduction in procurement, processing and distribution. Recommendations were made for implementing proposed changes in the premerger organizations.

The procedure was to determine the cost of existing operations from which estimated costs and returns of alternative operation and organization arrangements were made. The savings potential was given in five different alternative operational arrangements. Specifically, the study concluded that substantial savings would be realized through reorganization and elimination of overlaps in procurement routes; coordinated routing of milk from farm to the receiving station or market; elimination of uneconomical cross hauls of association milk; elimination of duplication in product processing activities by allowing plants to specialize in one product; and by relocating processing activities so as to move members' milk to market at the lowest possible cost.

Concerning the financial condition of the constituent cooperatives, an attempt was made in the feasibility study to provide an indication of the financial strength of the merging cooperatives. As an indication of financial strength, the cooperatives of the feasibility study had combined assets of over \$15,000,000. The combined current ratio was \$1.60 of current assets to \$1.00

current liabilities and member equity was over 60 percent of the value of total assets. Moreover, the premerger sales range was from \$1, 079, 946 to \$21, 128, 415, with a combined sales of over \$35, 000, 000.

The above data are an indication of strength; however, these data alone were not accepted as a substitute for a complete financial analysis by the case merger. Since a cursory review of the financial condition of the acquired firm could well be a costly error, a more complete appraisal of the financial condition of each cooperative was conducted and appeared as an adjunct to the economic feasibility study.

### The Role of the Advisors

The consummation of the case merger resulted from extensive efforts on the part of advising agricultural economists, accountants, and attorney. The role of each is discussed respectively.

The role of the economists during the merger was essentially to provide the professional advice during the premerger discussions and to conduct the feasibility study. In short, the economists provided the impetus for the decision to merge, and coordinated activities among the professionals, and between the professionals and the boards and members.

The role of the advising accountant was primarily to provide an analysis of the financial feasibility of merging with appropriate accounting tests and analysis of financial records. The accountant also conducted the auditing procedures of the constituent cooperatives' books.

The role of the attorney is generally the same in all unification projects regardless of the form--merger or consolidation. The attorney's role in the case merger was to provide legal counsel throughout the premerger discussions as well as the preparation and necessary processing of the legal documents. With respect to the latter task, the attorney was responsible for preparing the following documents: 1) the "Letter of Intent," 2) the plan of merger, 3) the articles of incorporation, 4) adjustments and revisions to the acquiring firms' by-laws, and 5) the articles of merger. The transfer of real property was not a specific task of the attorney since the mere act of filing the articles of merger conveys all interest in real and personal property. Although not applicable to this case, the attorney may be asked to provide assistance on such matters as transfer of vehicle registration, trademarks, etc.

The choice of advisors is important. The selection of competent and knowledgeable men can help the inexperienced cooperative cope with the uncertainty existing both before and

after the merger.

Although not applicable to this case, this author feels the role of a "merger manager" should be made evident. A "merger manager" should be appointed during the early stages of the pre-merger discussions. He is responsible for scheduling and overseeing the postmerger activities. Along with the responsibility for the completion of the postmerger activities, the "merger manager" should be authorized to recommend and implement necessary changes. Furthermore, he should be responsible for developing the PERT network for scheduling, evaluating and reviewing all postmerger activities. He should report directly to the General Manager.

In some cases the job of the "merger manager" may be performed by the General Manager so long as the requirements of the merger do not impair his day-to-day decision making function as the General Manager. Preferably, however, the "merger manager" acts as an on-the-scene representative of the General Manager to ensure that the critical decisions are effectively made following merger (Searby, 1969b).

#### IV. THE POSTMERGER ACTIVITIES

Once the decision to merge has been made, the constituent cooperatives must plan for the ensuing postmerger period which is typically one of uncertainty and confusion. In an attempt to alleviate this uncertainty this chapter provides inexperienced cooperatives with additional information which consists of the following: 1) a presentation of the activities actually performed by the case merger depicted within a descriptive network, 2) an individual discussion of the actual activities performed by the case merger with respect to their position within the descriptive network, and 3) a presentation of a prescriptive scheduling procedure based on the application of PERT to the case merger.

When dealing with a large number of activities, analysis and understanding is augmented by simplifying and classifying these activities. Thus, prior to accomplishing the above objectives it is well to provide a means of simplification and classification. Garoian and Haseley (1963a) have set forth key performance areas (KPA's) of a business enterprise for purposes of controlling performance. This is done in order that attention can be concentrated to a specific area when actual performance deviates from the desired performance. Similarly, throughout this chapter the KPA's of the case merger are identified as a means of simplifying

the discussion and analysis of the case merger data. This KPA concept is used in discussing the activities of the case merger in order to focus discussion on a given area (e. g., accounting, marketing, personnel, etc.).

### The Descriptive Network

Pedagogically it is well to present a descriptive network of the postmerger activities prior to discussing each activity individually and to developing a prescriptive network. In general, the descriptive network is a positive approach and provides a historical record of events and activities in the case merger; whereas, the prescriptive network is a normative scheduling approach resulting from the application of the PERT technique.

The descriptive network is presented here primarily for two purposes: first, to present the results of the case merger; and second, to provide a more meaningful framework for discussing the actual activity performance. An ancillary purpose is to provide a firmer understanding of the PERT system. Although the direct application of the PERT technique yields a prescriptive network, by presenting the activities of the case merger depicted within a descriptive network the reader can pictorially observe the exact postmerger procedure followed in a given situation together with gaining a greater appreciation for the value of network

construction, which is the basis of the PERT system.

It should be made clear that the case cooperative did not develop a network prior to entering the postmerger decision period; and, one can only speculate as to the savings that would have resulted from choosing such a desirable course of action. The following descriptive network (see Figure 2) was constructed by this author and is based on the decisions and events performed during the actual case merger. Bear in mind, however, this descriptive network is only a sample of experience, schematically representing a history of a particular merger, and does not provide a prescriptive procedure for scheduling uncertain postmerger activities.

The procedure taken by this author to develop the descriptive network was first, to identify all of the nonrecurrent activities which had to be completed to accomplish the objectives of the case merger. This data was provided by the individuals responsible for each of the identified KPA's. Consistent with the requirements of network construction, all of the events were placed in a logical sequence and classified as either predecessor or successor events, representing those events which were completed before another event was started and those events which came after the completion of another event, respectively.

Next, all of the nonrecurrent events necessary to complete

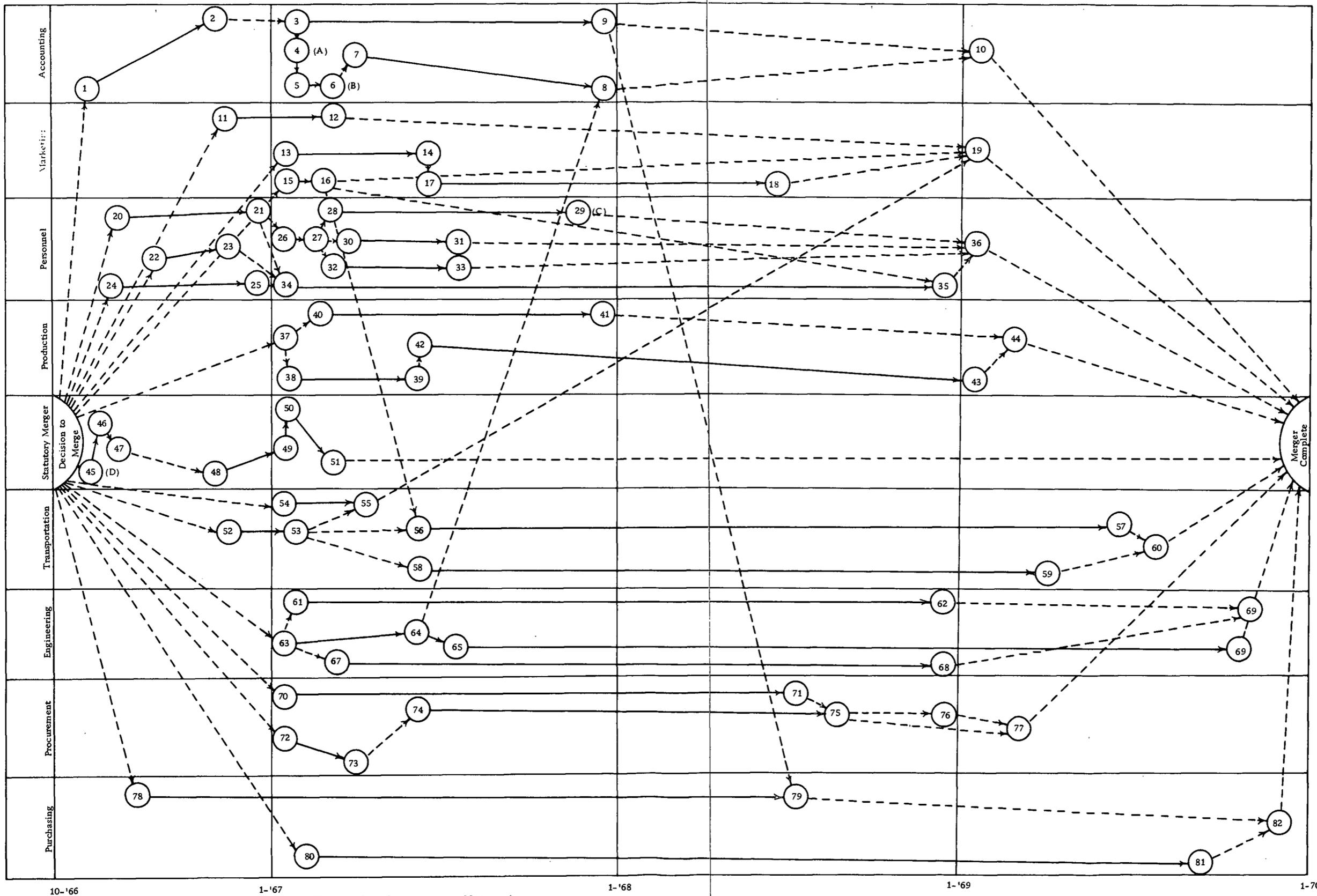


Figure 2. Descriptive Network

10-'66

1-'67

1-'68

1-'69

1-70

Descriptive Network Events for the Case Dairy Cooperative Merger

Accounting

- (1) Begin to devise branch manual
- (2) Complete branch manual
- (3) Begin computerizing accounting
- (4) Close books
- (5) Open books of combined cooperative
- (6) First combined financial statements
- (7) Begin branch financial statements
- (8) Complete branch financial statements
- (9) Complete centralizing accounting
- (10) Centralized accounting (sub-goal)

Marketing

- (11) Start sales training sessions
- (12) Complete sales training sessions
- (13) Begin to review pricing, credit, and advertising procedures
- (14) Complete review of pricing, credit, and advertising procedures
- (15) Begin sales route reorganization
- (16) Complete sales route reorganization
- (17) Begin to change pricing, credit and advertising procedures
- (18) Complete change or pricing, credit, and advertising procedures
- (19) Create favorable image (sub-goal)

Personnel

- (20) Begin survey of all employees
- (21) Complete survey of all employees
- (22) Begin to revise job descriptions
- (23) Complete revision of job descriptions
- (24) Begin to determine Branch Manager assignments
- (25) Complete assignments of Branch Managers
- (26) Begin to obtain personnel records
- (27) Finish obtaining personnel records
- (28) Begin to standardize benefit plans
- (29) Complete standardization of benefit plans
- (30) Begin to unify personnel policies
- (31) Finish unifying personnel policies
- (32) Begin to implement safety program
- (33) Finish implementing safety program
- (34) Begin to determine and adjust manpower needs
- (35) Finish determination and adjustments to manpower needs
- (36) All personnel information standardized and manpower needs adjusted (sub-goal)

Descriptive Network Events for the Case Dairy Cooperative Merger--Continued.

Production

- (37) Hold meeting to inform production people of proposed production adjustments
- (38) Begin to review production and product lines
- (39) Complete review of production and product lines
- (40) Start scheduled quality control meetings
- (41) Finish quality control meetings
- (42) Begin to adjust production areas
- (43) Complete production adjustments
- (44) Efficient production (sub-goal)

Statutory Merger

- (45) Prepare plan of merger
- (46) All boards of directors approve plan of merger
- (47) Members approve plan of merger
- (48) Prepare articles of merger
- (49) File articles of merger
- (50) Begin tenure of interim board
- (51) First annual meeting of members (sub-goal)

Transportation

- (52) Begin vehicle survey
- (53) Complete vehicle survey
- (54) Begin to paint vehicles and facilities and issue new uniforms
- (55) Complete painting facilities and vehicles and issuance of new uniforms.

- (56) Begin interplant vehicles transfers
- (57) Complete interplant vehicle transfers
- (58) Begin to adjust maintenance facilities
- (59) Complete adjustments to maintenance facilities
- (60) Economic transportation (sub-goal)

Engineering

- (61) Begin to standardize procedures on equipment use
- (62) Complete standardization of procedures on equipment use
- (63) Begin inventory of facilities and equipment
- (64) Complete facility and equipment inventory
- (65) Begin adjusting facilities and equipment
- (66) Complete adjustments to facilities and equipment
- (67) Begin review and adjustments of utility utilization
- (68) Complete utility adjustments
- (69) Physical production techniques adjusted (sub-goal)

Procurement

- (70) Begin signing new marketing agreements
- (71) Complete signing of marketing agreements
- (72) Begin adjusting farm-to-processor hauling rates

Descriptive Network Events for the Case Dairy Cooperative Merger--Continued

- (73) Complete farm-to-processor rate adjustments
- (74) Begin to adjust interplant hauling rates
- (75) Complete adjustment of interplant hauling rates
- (76) Meeting to explain new hauling rates
- (77) Employ new hauling rates (sub-goal)

Purchasing

- (78) Begin to determine purchasing procedures
- (79) Complete determination of purchasing procedures
- (80) Begin to centralize and coordinate purchasing procedures
- (81) Complete centralization and coordination of purchasing
- (82) All purchasing centralized and coordinated (sub-goal)

Explanatory Notations for the Descriptive Network

- (A) All of the constituent cooperatives closed and audited their own books. The closing entries of all the accounts were transferred to the surviving firm.
- (B) The first monthly financial statements were computed from a noncomputerized accounting system.
- (C) The rationale for the lengthy period to standardize the benefit plans was that it was considered best to let the existing plans expire before initiating new benefit plans.
- (D) The articles of incorporation are included in the plan of merger.
- (E) Upon filing the articles of merger with the state corporate commissioner the merger becomes legally effective. The reason for filing the articles of merger on January 1, 1967, was that this date was the end of the fiscal year for all of the constituent cooperatives. Furthermore, the by-laws specify policies of membership representation and the procedure of electing board members.

the merger were diagrammatically depicted in a network (see Figure 2). This network is an event-oriented approach representing a description of the actual events that occurred in the case merger.<sup>7/</sup> Note that the vertical axis portrays a breakdown of the nine KPA's; time is depicted on the horizontal axis. The events (start or completion of an activity) are represented by the circles in the diagram. The solid lines indicate interdependencies and the flow of resources among events. The broken lines also indicate interdependencies; however, no resources are consumed. The last event is the merger objective of each functional area and since there is a time dimension attached to the completion of the objective it was termed a sub-goal. The accomplishment of each sub-goal represents each area's contribution to the overall goal of unified synergy. Each sub-goal was reached by either simultaneous or sequential activity paths. Upon the completion of each sub-goal, each KPA had completed its portion of the merger and was therefore able to contribute its unused resources to other areas of need.

#### Description of Actual Postmerger Activities

The purpose of this section is to describe the actual procedure taken by the case merger in performing their postmerger decisions and activities and thus provide a detailed explanation of

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<sup>7/</sup> The descriptive network is an event-oriented network, whereas, the prescriptive network is activity-oriented.

the activities depicted in the descriptive network. Unless inapplicable, each functional area is considered to be a KPA and is discussed with respect to:

- 1) The importance of the functional (KPA) area to the merger;
- 2) The relation of the functional sub-goal to the overall goal of the merger;
- 3) A description of the critical nonprogrammed activities which were performed to reach the functional sub-goal,
- 4) The relation of each activity to the functional sub-goal, and
- 5) The major problems encountered by the case merger in performing the postmerger decisions and activities.

Following this section a normative approach towards scheduling postmerger activities is presented via prescriptive network. However, prior to employing the PERT technique it is well to discuss individually each activity according to the above five criteria and with respect to their position in the descriptive network.

### Accounting

The accounting system provides management with information needed for decision making. Accounting systems provide data that are historical in nature; however, predictive implications may also be provided. In addition to the information requirements of the Internal Revenue Service and other regulatory agencies, the

decisions which must be made by management should determine the basic types of information generated for management decisions.

Because virtually all other functional areas of the cooperative depend upon some type of accounting data, a rapid completion of the accounting tasks is desired. After the decision to merge, the accounting department is confronted with various nonprogrammed tasks it must perform in order to complete its segment of the merger. These tasks are, by definition, conducted within an environment of uncertainty, that is, the decisions which must be made within the accounting area are conducted under conditions of imperfect knowledge and thus their solution depends upon the accountant's previous experience with similar programmed accounting tasks and recommendations from professional advisors.

In the accounting department's attempt to provide a more knowledgeable working environment, a sub-goal was specified. A plausible sub-goal would appear to be the completion of the first combined financial statements.<sup>8/</sup> However, the responsibility of the accounting department was not considered to be accomplished until all of the accounting functions were centralized and individual financial statements were developed for each branch. Thus, the

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<sup>8/</sup> Financial statements include income statement, balance sheet and capital statement.

sub-goal of the accounting area was (a) to complete the centralization of all accounting information, and (b) to develop individual branch financial statements. The accounting area did not become a bottle-neck during the postmerger decision period of merger, whereas, it more easily could in a consolidation form of unification. Generally during consolidation the accounting systems of the constituent cooperatives are dissolved and a new system implemented; thus, because the people are unfamiliar with the system, the completion of the various nonprogrammed accounting tasks is likely to be delayed (Wentzel, 1968b). However, generally during merger the integration process is one of converting the accounting procedures of the "acquired" cooperatives to that of the surviving cooperative, and the case merger was no exception.

Large savings were realized from centralizing and computerizing the accounting functions of the case cooperatives. These savings primarily resulted from a large reduction in clerical expenditures. Therefore, because of the potential savings attainable after merger, a rapid integration of the accounting information was desired. Furthermore, a rapid completion of the accounting responsibilities minimized the decision making uncertainty of the other KPA's by providing accurate and timely decision making data.

Devise Branch Manual: A manual specifying the accounting procedures and methods of the combined cooperative was used in

the attempt to minimize the uncertainty throughout the remainder of the postmerger period. This activity was critical to merger completion and preceded all other accounting activities. Although the branch manual also specified the procedures of other KPA's, it is discussed within the accounting department because of its emphasis on the accounting activities and its formulation by the accounting department.

This activity was initiated by the case merger immediately after the members approved the plan of merger because of the decision making information demands from the other KPA's. Essentially the branch manual specified the procedures relating to all flows of cash together with the prescribed coding of accounts and forms for making each transaction. For ease of understanding, the branch manual included examples of completed necessary forms. A problem faced by the case merger in the attempt to devise a workable instructional manual was that upon the date of completion many of the sections were already outdated. Thus, constant revision by the surviving cooperative was necessary to maintain an effective branch manual.

Furthermore, prior to the legally effective date of merger, extensive efforts were made to acquaint the "acquired" cooperatives with the procedures of the branch manual. Special meetings of affected staff were conducted for just such purposes.

Integrating the Accounts: Twelve months is the standard length of the fiscal period. At yearly intervals throughout the life of a business enterprise it is necessary to summarize and report operating and financial data for owners, creditors, and other interested persons. It is also necessary to prepare the ledger for entries of the ensuing year. Regardless of whether interim statements have been prepared at the end of each month, it is necessary to record adjusting and closing entries at the end of each fiscal year.

The above reports were programmed activities of the case merger. However, the process of integrating the accounting activities after merger is a nonprogrammed activity. Prior to making the final closing entries in the constituent cooperatives' books, the final audits must be made. Immediately after the books were transferred to the surviving cooperative, the books were reviewed by the advising accounting firm. Moreover, the entire process of integrating the accounts of the five cooperatives was carefully supervised by an advising accounting firm.

Computerize Accounting: The development of an effective management information system in a firm of this magnitude generally requires the aid of a computerized accounting system. The computer serves as a tool to provide managers with timely information needed for effective decision making.

Since four cooperatives were "acquired" in the case merger,

all could not be computerized simultaneously. All of the "acquired" cooperatives were originally performing their accounting tasks manually, thus, their original procedures were significantly different from the surviving cooperative's computerized system. Hence, the computerization process was indeed shrouded with uncertainty.

Since all of the constituent cooperatives could not be integrated into the computer system simultaneously, some accounting tasks were assigned priority over others. This priority was consistent with the information demands of the other KPA's. For example, the accounts receivable and inventory information were among the first activities computerized because of the timely and accurate information requirements of the marketing department.

Combined Financial Statements: After the legally effective date of a unification project all people involved are anxious to receive a measure of performance for the combined operations. Such a measure is provided by the first income statement.

The first combined income statement of the case merger was prepared after the first month of combined operations. This was accomplished by aggregating the income statements of the constituent firms since all of the accounting had not been sufficiently computerized. Despite the performance measure provided by this beginning income statement, no meaningful appraisal of the success of the merger could be made within such a short time period. In fact,

because of the uncertainty shrouding the integration of the five case cooperatives, a three-year time period was required to determine the actual success of the merger.

The first combined balance sheet after the final audit provided an indication of the relative strength of the combined cooperatives. Although the aggregated balance sheets did indicate the relative strength of the firm, sufficient time had to elapse before a more realistic appraisal of the financial condition of the merged cooperatives could be determined. This time period was necessary because of the complexity of standardizing the information reporting practices among the five cooperatives.

Branch Financial Statements: Analogous to the combined financial statements, the management of the constituent cooperatives desired a measure of performance for each branch; such a measure was provided by the branch financial statements. The completion of this activity provided greater information to allow for improved management decision making. For example, the branch statements were used for evaluating the exact contribution of each branch to the newly combined cooperative. Such a procedure provided a more objective basis for further reallocation of resources. By completing the branch financial statement activity together with the accounting computerization activity the sub-goal of the accounting department was reached.

Upon examination of the descriptive network, two simultaneous activity paths within the accounting KPA are viewed; the first consists of computerizing and centralizing the accounting systems of the "acquired" cooperatives, and the second essentially consists of formulating the financial summaries of the operations. Both paths were pursued concurrently in the quest for the accounting sub-goal.

### Marketing

The sub-goal of the marketing area--creation of a favorable image--can be divided into two separate parts: first, the creation of a favorable image among the salesmen, and second, the creation of a favorable public image. Bear in mind that these two parts are by no means discrete.

Unfortunately, many employees of the case merger had a preconceived unfavorable image of merger. Thus, the sub-goal of the marketing area was directed toward re-shaping this image and in so doing, minimizing employee resistance to change. This was accomplished primarily through extensive educational sessions with the salesmen supervised by the general sales manager. The objective of these sessions was to establish confidence in the merger and gain the support of the salesmen. In short, the purpose of the

sessions was to sell the salesmen on the merger.

The result of successful educational sessions was the relay of a favorable image from the salesmen to the public. From the very beginning of merger the case cooperative attempted to present a favorable community image. This image was not only presented through the salesmen, but also through a coordinated effort on the part of all other departments. For example, through a joint effort of transportation and engineering departments, vehicles and facilities were re-painted. Also, new uniforms were issued to salesmen. These activities, and others, were directed towards creating a favorable public and unified image.

Despite its specification within the marketing area, the creation of a favorable image was a tacit objective of all functional areas. To alleviate the uncertain attitude toward merger on the part of personnel and the public, an attempt to create a favorable image of the merger was initiated promptly after the decision was made to merge.

Conduct Sales Training Sessions: This activity was critical to the attainment of the marketing sub-goal in the case merger. The sales people were periodically briefed after merger as to the advantages and strengths of merger along with necessary procedural clarification. Since the surviving cooperative assumed all authority subsequent to merger, it had to prove to the people involved that

it was a "going concern" in order that it could receive satisfactory cooperation from the people involved. Moreover, the major purpose of this activity was to create a favorable merger image among the salesmen in the hope that the image would be relayed to the customer.

The sales training sessions were conducted simultaneously with the remaining activities of the marketing area. The training sessions were conducted by the general sales manager and personnel manager in conjunction with each branch manager. A rapid and successful completion of this activity contributed significantly to the marketing sub-goal and the overall synergistic effects of the unification.

Reorganization of Sales Routes: Substantial savings can be realized through reorganization and coordination of the wholesale and retail sales routes of many firms. The payoff from completing this activity is greatest when the constituent cooperatives supply portions of identical markets. As a result of merger, overlapping of the distribution routes can be eliminated. Such a situation existed in the case merger and consequently savings were realized accordingly.

Furthermore, the tasks of adjusting the manpower needs to the available work force was largely dependent upon the completion of the sales route reorganization activity. Thus, this

activity was completed promptly so that the determination of the manpower requirements could be made.

Review Present Pricing, Credit, and Advertising Procedures:

A comprehensive review of the pricing, credit, and advertising procedures of the constituent cooperatives was initiated immediately after the decision to merge. Such a review was conducted by the individuals responsible for determining and monitoring these policies for the acquired cooperatives (i. e., general sales manager, credit manager, and branch manager).

Adjust Present Pricing, Credit, and Advertising Procedures and Policies: Adjusting and coordinating the pricing, credit, and advertising policies of the constituent cooperatives was the most resource consuming activity of the marketing KPA; and, no less important were the potential synergies resulting from a rapid and effective completion of this task. Substantial savings were the result of coordinating these activities.

The pricing procedures of the case merger were adjusted at a gradual rate subsequent to the determination of the present procedures. The case cooperative elected the role as a risk averter in attempting to change the existing procedures. By taking this course of action substantial savings were realized and one can only speculate as to the potential loss that might have occurred from choosing the more risky action of changing all existing

procedures immediately upon merger. Thus, by gradually adjusting and coordinating the pricing procedures among all branches, the "people problems" were minimized and the favorable image was enhanced. This gradual rate of adjustment should not be misconstrued to be inconsistent with the assumption that a rapid integration process is desired. Shortening the total time period of the merger does not necessarily mean that the performance of each activity should be unduly accelerated. In other words, a rapid integration process does not necessitate irrational activity performance.

Unlike the pricing procedures, the credit procedures were explicitly spelled out in the branch manual and rigidly enforced. Aging of the wholesale and retail accounts were computerized as soon as possible in order to alleviate loss on unpaid accounts.

Coordination of the advertising effort was slackened because of the burdensome resource demands of unification. Such a procedure proved costly to the merger. Advertising efforts should be coordinated promptly because of the potential losses resulting from uncoordinated advertising programs, or the absence of such programs.

The pricing, credit, and advertising decisions that were made hinged on considerations such as consistency with long-run market projections, the capital structure of the surviving cooperative, and

its competitive position in the market.

### Personnel

Personnel problems have been described as the major limiting obstacle encountered during a unification project (Mather, 1966). This conclusion is consistent with the findings of this study. Because of the personal nature of farmer cooperatives, sound postmerger decisions were delayed or not even attempted for fear of injury to relations among fellow employees.

In an attempt to direct resources more efficiently, the personnel department specified a dual sub-goal: the standardization of the necessary personnel documents and the completion of the adjustments of personnel to manpower needs. The following activities were accomplished by the personnel department on the path to achieving their sub-goal.

Survey of all Employees: A survey of all employees of the constituent cooperatives was given immediate attention after merger. Before any action was taken within the personnel area, each employee was evaluated to determine his contribution to the combined cooperative. Such a survey provided improved decision making information for succeeding personnel decisions. For example, in the case survey, many employees were found not to be working to their greatest potential. Hence, this activity

provided a realistic picture of the employee situation, thus enabling effective manpower adjustments to be made.

Revise Job Descriptions and Reporting Relationships: After the decision was made to merge, a number of the key employees involved eventually had re-defined responsibilities and/or reporting relationships viz., branch managers. Thus, in the attempt to alleviate much of the confusion and uncertainty resulting from a lack of a job description, each employee was promptly provided an explicit description of his job responsibilities. Moreover, he was made aware of the revised organizational structure and his position in it.

In the case merger this activity involved only revision or addition to the existing management manual of the surviving cooperative.<sup>9/</sup> As new positions were created or organizational changes made, the management manual was revised accordingly.

Determination and Adjustments to Manpower Needs: Growth by unification provides the possibility of reducing costs by specializing personnel and thus reducing the number of employees and/or coordinating their efficiency. However, before the benefits resulting from the manpower adjustments could be realized, the

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<sup>9/</sup> The surviving cooperative maintained a management manual consisting of a job description for each key employee and the organizational chart.

number of employees desired were determined. However, the determination and adjustment activities were not discrete but highly interrelated and their performance occurred simultaneously.

The manpower adjustment activity was supervised by the personnel manager, however the specification of the manpower needs were submitted by other KPA's. For example, the employee survey provided the personnel department with the actual performance of each employee; and, from this information the personnel department delegated to each KPA the authority to make the necessary adjustments.

Choosing a course of action which eliminates in a short period many employees in a given locality is likely to be injurious to community support and the general image of merger. The cost reduction benefits resulting from such a radical elimination procedure must be weighed against the costs incurred. The case merger, however, chose a more conservative course of action by pursuing a gradual elimination program.

Obtain Personnel Records: A minimum degree of knowledge of each employee is required to meet the demands of governmental agencies, insurance companies, the accounting department, etc. This information was kept in a centralized file under the control of the personnel manager. Such a file was established as resources permitted.

Standardize Benefit Plans: The case merger united a conglomeration of benefit plans. Standardization of these plans was completed as soon as feasible. This task consisted of converting the benefit plans of the constituent firms to one that was acceptable to most employees. Many employees were sensitive about such a transition and thus the advantages of the new plan were stressed together with comparisons and needed explanations. Moreover, the best interests of the employee were served by letting their existing plans expire prior to making the transition to the new benefit plan.

### Production

Economies of scale were a major objective of the case merger. Consequently, as long as diseconomies were not encountered, average costs could be expected to decrease as plant volume increased. Thus, through the case merger program of specialization and concentration of production, costs were expected to decrease and profits increase by expanding output.

The functional sub-goal of the production area was to complete the recommended adjustments of the production techniques among the various branches. The attainment of this sub-goal was critical since by its completion more efficient production was achieved, thus enhancing the synergistic benefits. The production

decisions also involved decisions about people, and the resistance to change problem had to be coped with properly so as not to impede the production adjustments.

Production Meeting: The initial activity within the scheduled production sequence was to arrange for a meeting of all production people. This meeting was necessary to explain and clarify projected production adjustments and to establish a favorable working environment. The meeting was conducted by the production manager together with a selected team of production people.

Review of Premerger Production: A comprehensive review of premerger production procedures preceded the production adjustment activity. The effective completion of this activity provided the production staff with more complete information on the production procedures and operational structure of the constituent cooperatives, thus enabling more rational decision making regarding production adjustments. The objective appraisal of the current production structure provided a firmer basis for conducting the subsequent production adjustment decisions.

Adjust Production Areas: A vast amount of resources are consumed in adjusting the recommended production areas of a merger requiring concentration and specialization of production. The adjustments of the case merger closely followed the feasibility study recommendations and the results of the preceding

activity. Any major deviations from the feasibility study recommendations were given careful consideration.

The adjustment process was complex and costly. Consequently, all of the necessary adjustments could not be performed simultaneously. Each adjustment was conducted according to a specified priority list consisting of those activities with the greatest expected contribution to synergy.

Quality Control Meetings: Consistent with the creation of a favorable merger image objective and the production sub-goal, meetings were scheduled periodically to clarify and review quality control procedures. The meetings were conducted simultaneously with the production review and adjustment activities.

### Statutory Merger

The role of the advising attorney has been discussed in Chapter III. The attorney's duties are standard regardless of the type of unification--merger or consolidation. Oregon Revised Statutes specify the legal procedures necessary to consummate a unification project.<sup>10/</sup>

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<sup>10/</sup> Statutory unification procedures are specified in the Oregon Cooperative Corporation Act--ORS 62.605 to 62.620.

Prepare Articles of Merger: Following the adoption of the plan of merger the articles of merger were prepared. The articles consist of: a) the plan of merger, b) the date of adoption of the plan, and c) as to each cooperative, the number of members votes cast for and against the plan. Duplicate articles of merger were then delivered to the State Corporate Commissioner where, upon approval, the merger became legally effective.

Interim Board of Directors: Prior to the election of a permanent board of directors the establishment of a temporary board was necessary to provide "equality of representation" among the cooperatives during the interim period. In the case merger, the interim board consisted of the surviving cooperative's board plus one board member from each of the "acquired" cooperatives. The tenure of the interim board lasted until the first annual meeting where upon the membership areas were re-districted and apportioned according to the surviving cooperatives' by-laws.

### Transportation

The elimination of duplication and cross hauls in product procurement and distribution was a major component of the case merger's decision to unify. However, the reorganization of product routing necessitates major adjustments on the part of the transportation department. Thus, upon fulfilling the

transportation demands of the other functional areas, the sub-goal--economic transportation--was achieved.

Vehicle Survey: This activity was scheduled first among the transportation nonprogrammed activities. A competent individual performed this task for each of the "acquired" cooperatives. Standard criteria were used in the attempt to obtain an accurate and objective appraisal of all vehicles.

Adjust Vehicles and Maintenance Facilities: Immediately upon completion of the vehicle survey the conspicuously inefficient and inadequate maintenance facilities were eliminated. Further adjustments depended primarily upon the demands of the other functional areas. In short, the major concern of the transportation department was to provide economic transportation by adjusting the vehicles and maintenance facilities to the needs of the other departments viz., marketing.

### Engineering

The engineering department is responsible for the physical installation, adjustments, and maintenance of all facilities and equipment. The scheduling of the nonprogrammed activities of the engineering department were, for the most part, dependent upon the recommended production adjustments; and, upon fulfilling these requests, the sub-goal--physical production techniques

adjusted--was achieved.

Inventory of Facilities and Equipment: The first activity scheduled within the engineering department was to take inventory of all existing facilities and equipment of the merging cooperatives. Since financial statement preparation depended upon inventory information, a rapid and accurate completion of this activity was desired. Furthermore, the inventory was conducted by a competent individual to obtain an objective and accurate physical inventory, thus enabling the initiation of effective facility and equipment adjustment programs.

Adjust Facilities, Equipment and Operating Procedures: The engineering department maintained the responsibility and authority to make the necessary adjustments as determined by the preceding inventory and requests from the production department. A priority list was specified by the production department so that this activity could be more effectively performed.

In general, physical production adjustments are a prerequisite to production efficiency; however, this does not mean that physical adjustments will necessarily result in efficiency. Following the physical production adjustments, efficient operation of the facilities and equipment is required to obtain the greatest benefits of synergy. In the case merger, operating

procedures were closely supervised and periodically reviewed in the quest for optimal operating efficiency.

### Procurement

The unification of the case dairy cooperatives presented the possibility of reducing transportation costs by coordinating routing and assignment of raw product to destinations. Substantial savings resulted from reorganization of routes, which reduced the average length of routes, increased the volume of pickup per mile, and minimized the number of partial loads. The greatest possibility for cost savings in procurement areas is where considerable route overlaps exist.

Extensive procurement route reorganization was complicated. Consideration had to be given to the attachment and loyalty that developed between the producer and existing contract haulers. The performance of this activity required a patient, fair and understanding approach on the part of the surviving cooperative. Thus, the sub-goal of the procurement area was to establish new hauling routes and rates while maintaining favorable member relations.

Adjust Hauling Rates: In the case merger all producers benefitted from reduced processing costs that occurred from specialization and concentration of production. However, these gains were partially offset by higher hauling costs, particularly

where surpluses existed in a production area and interplant transfer was distant, resulting from relocation of processing activity.

Therefore, some arrangement was needed for pooling transportation costs so that distant producers were not excessively penalized from merger.

The original method chosen by the case merger was to pool all hauling and transfer costs and divide them equally over all production. However, this method had a major limitation; if the costs were divided evenly among all producers, the producers with a minimum hauling cost would be subsidizing those with more distant hauls. Such a procedure resulted in member dissension because some producers opposed subsidizing the hauling costs of others. Since this method proved undesirable, a more acceptable method was initiated which consisted of assigning every producer a pro-rata share of the total hauling cost based on his geographical location to the processing facility.

### Purchasing

Pecuniary economies of large-scale buying are often a characteristic of the multiplant firm (Bain, 1968a). If realizable, such economies can be expected to result in decreased per unit costs through unification. More specifically, the case merger realized these pecuniary economies by obtaining decreased per

unit costs as the result of centralizing and coordinating the purchasing activities of the constituent cooperatives. These savings were the result of purchasing supplies, equipment, and product ingredients in large quantities so as to take advantage of quantity discounts, reduced transportation costs, and increased bargaining power for lower prices.

Analogous to many other postmerger functions, the process of integrating the purchasing activities of the case merger was basically one of converting the "acquired" cooperatives' purchasing procedures to that of the surviving cooperative. However, as a result of centralizing purchases, many local suppliers were eliminated. Although such a course of action upset relationships with many local suppliers, it was decided that the expected financial savings outweighed the expected loss. Thus, in the quest to achieve these savings, the sub-goal--to centralize and coordinate all purchases--was specified.

Determine Purchasing Procedures: Purchases had to be determined by individual items regarding their source of supply, prices paid, and quantities bought. Such a procedure was necessary to compare alternative purchasing decision payoffs to their respective opportunity costs. However, the determination of this information depended upon the completion of the accounting computerization activity because of the information necessary

to enable optimal purchases.

Centralizing and Coordinating Purchases: Immediately upon the legally effective date of merger the surviving cooperative took control of all monetary disbursements. By so doing, all purchasing had to be approved by the purchasing department of the surviving cooperative. Moreover, the specific purchasing procedures were explicitly specified in the branch manual and promptly followed by educational sessions for purposes of procedural clarification. These sessions were critical in the cooperative's attempt to minimize the "people problems". As in most other postmerger activities, the "people problems" were a major obstacle hindering the rapid completion of the purchasing centralization and coordination process. These "problems" were reflected in the "acquired" cooperatives' desire to remain autonomous after merger regardless of the financial savings resulting from centralizing and coordinating the purchasing activities.

### The Prescriptive Network

This section provides merging cooperatives with a guide to follow in order to achieve maximum effectiveness following the decision to merge. Such a guide is given by the prescriptive network derived from the application of the PERT technique.

Deduced from an analysis of the case study, the information presented in the prescriptive network serves as a normative approach toward scheduling postmerger decisions.

The descriptive network is simply a pictorial representation of the actual scheduling of activities by the case merger; however, the prescriptive network represents an application of the PERT technique to postmerger activities by the author. The PERT technique predicts project completion dates by considering three time estimates (optimistic, most likely, pessimistic). The time estimates of the following network represent calendar days (see Figure 3).<sup>11/</sup>

### The PERT Results

The results of the application of the PERT technique to the postmerger activities are indeed revealing. The sequence of activities C-P-BB-EE<sup>12/</sup> was determined to be the critical path, that is, this sequence is the longest in the network and all others

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<sup>11/</sup> Refer to the PERT methods of Chapter I for interpretation of the prescriptive network.

<sup>12/</sup> The activities on the critical path are: C, determine advertising procedures; P, reorganize sales routes; BB, determine employees needed; and EE, adjustments personnel.

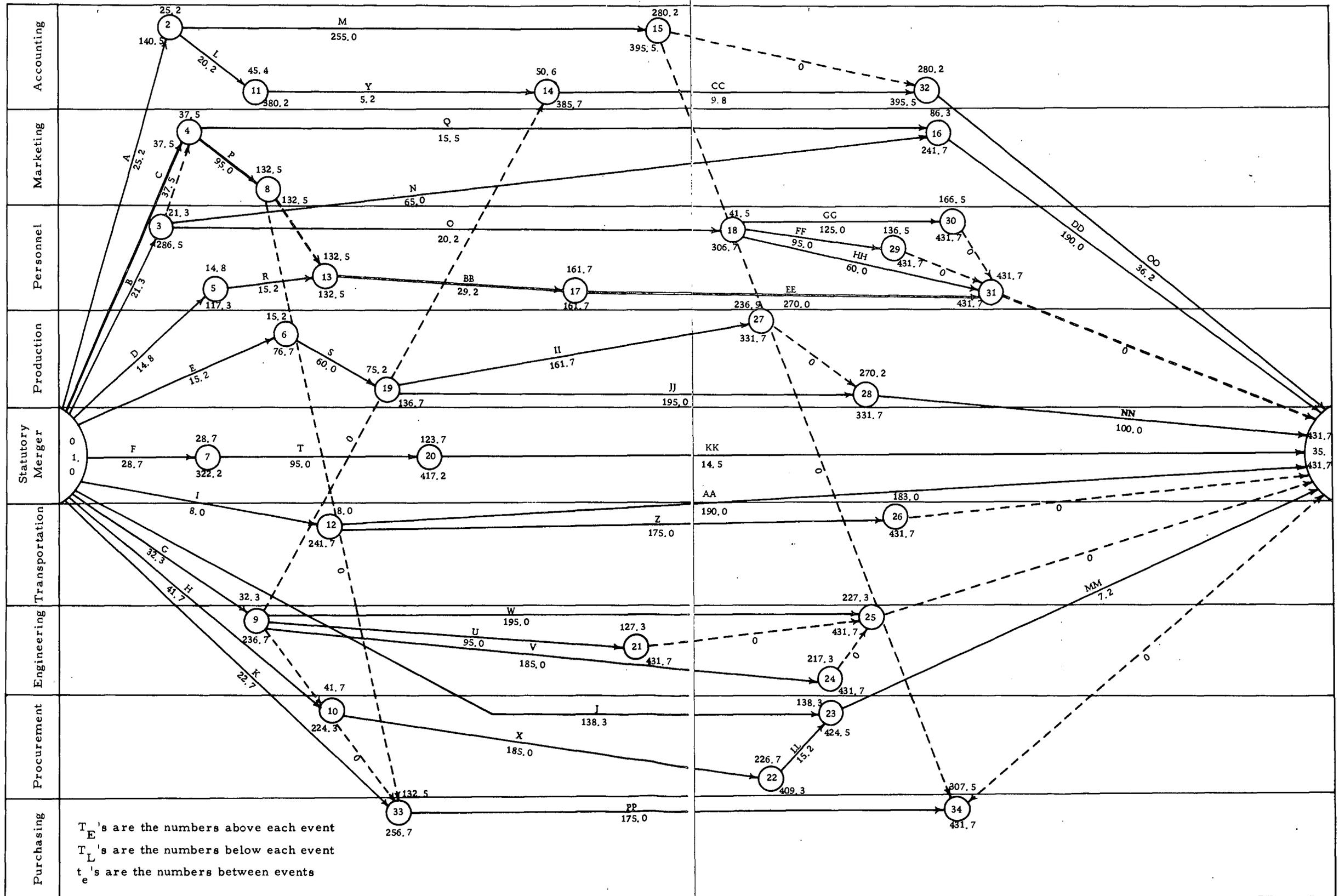


Figure 3. Prescriptive Network.

The Prescriptive Activities

- |  |  |
|--|--|
| (A) Devise Branch Manual                                   | (AA) Adjust Vehicles                                   |
| (B) Survey All Employees                                   | (BB) Determine Employees Needed                        |
| (C) Determine Advertising Procedures                       | (CC) Combined Financial Statements                     |
| (D) Construct Job Descriptions and Reporting Relationships | (DD) Adjust Pricing, Credit and Advertising Procedures |
| (E) Production Meeting                                     | (EE) Adjustments to Personnel                          |
| (F) Prepare Articles of Merger                             | (FF) Unify Personnel Policies                          |
| (G) Take Facility and Equipment Inventory                  | (GG) Standardize Benefit Plans                         |
| (H) Adjust Farm to Plant Hauling Rates                     | (HH) Implement Safety Program                          |
| (I) Conduct Vehicle Survey                                 | (II) Quality Control Meetings                          |
| (J) Obtain Marketing Agreement Signatures                  | (JJ) Adjust Production Areas                           |
| (K) Determine Purchasing Procedures                        | (KK) First Annual Meeting                              |
| (L) Close Books  | (LL) Member meetings                                   |
| (M) Computerize Accounting                                 | (MM) Implement Interplant Rates                        |
| (N) Conduct Sales Training Sessions                        | (NN) Conduct Efficiency Study                          |
| (O) Obtain Personnel Records                               | (OO) Branch Financial Statements                       |
| (P) Reorganize Sales Routes                                | (PP) Coordinate Purchasing                             |
| (Q) Review Present Pricing and Credit Procedures           |  |
| (R) Branch Manager Placement                               |  |
| (S) Review Premerger Production                            |  |
| (T) Interim Board of Directors Tenure                      |  |
| (U) Adjust Equipment Use Procedures                        |  |
| (W) Adjust Equipment                                       |  |
| (X) Adjust Interplant Rates                                |  |
| (Y) Open Books   |  |
| (Z) Adjust Maintenance Facilities                          |  |

can be expected to be completed prior to it. Furthermore, the expected time required to complete the activities of the critical path (and merger) is 432 calendar days or just over 14 months (this result represents the Z's in the formal decision theory framework of Chapter II). The critical sequence of the events is located within the marketing and personnel areas (see Figure 3).

The first critical activity--determination of advertising procedures--is with the marketing area. Early completion of this activity is recommended so that effective allocation and coordination of advertising expenditures can be implemented. Marketing is critical not only from the standpoint of effective resource allocation, but also in the quest for the creation of a favorable image. As has been pointed out, creation of a favorable image should be a tacit objective of all KPA's from the early stages of merger.

The second activity in the marketing area is reorganization of sales routes. Since the determination of transportation requirements and employees needed are directly dependent upon the reorganization of sales routes, prompt completion of this activity is important in facilitating the coordination process.

The determination of employees needed and adjustments to personnel are the two personnel activities on the critical path. These activities are not discrete but highly interrelated and, to

a large extent, depend upon the personnel needs of other KPA's. Furthermore, these activities are time-consuming because of the "people problems" encountered in making the necessary adjustments. Even though "people problems" inevitably evolve, this activity, as well as all of the activities on the critical path, must be completed within their corresponding expected times ( $t_e$ 's) so as not to delay merger completion.

#### The "E" and "R" of PERT

Other than the determination of the critical path and the merger completion date, additional benefits are provided by using the PERT technique in merger situations. In order that the cooperatives may obtain the complete benefit from scheduling postmerger activities via PERT, more than planning (P) is required; evaluation (E) and review (R) procedures should also be considered.

Evaluation and review allow for a continuous status report on the progress of an on-going project; thus enabling improved control throughout the scheduling and performance of the post-merger activities. Garoian and Haseley (1963b) have defined control as a function by which comparisons are made between what is actually achieved and what was intended to be achieved. To maintain this control, evaluation and review of current and projected progress should be performed continuously throughout the

project duration via special meetings held periodically after the start of the work project. In so doing, a comparison of the actual achievement with the expected achievement can be made.

The key performance areas (KPA's) previously specified for simplification and clarification purposes also facilitate the control function as indicated by Garoian and Haseley:

The most effective control occurs when major attention is given to those business performance areas which are vital to the survival of the company. (1963b, p. 77)

Thus, the "E" and "R" of PERT should be focused on the KPA's for effective postmerger control. This focus allows for the continuous reallocation of resources from surplus resource areas to areas of resource deficiency.

A cursory review of both the descriptive and prescriptive networks in the chapter shrouds the simplicity objective of network construction. Upon comparison of the two networks, the differences between them are difficult to detect. However, only three activities distinguish the two networks, that is, three additional activities are included in the prescriptive network that are not included in the descriptive network (i. e., branch manager selection, determination of advertising procedures, and conduction of an efficiency study).

The basic components and activity relationships of the two networks are nearly identical, however this does not imply the

networks are near substitutes. The major difference lies in the element of time involved to complete the unification process.

More specifically, the descriptive network spans three years, whereas the prescriptive network spans 14 months. Both networks complete the same unification project; however, the latter is completed with the advantageous hindsight of a previous merger.

As indicated by top management personnel of the case merger, immeasurable savings could have resulted from shortening the integration process by having prior knowledge of the necessary decisions and activities constituting a dairy cooperative merger.

The network difference is indeed important since this study is based on the supposition that time is a critical factor affecting the potential synergistic benefits.

## V. ACTIVITY SCHEDULING IN PERSPECTIVE

A tacit assumption of this study is that the minimization of uncertainty following merger will enable a more rapid and effective unification project; moreover, a rapid and effective merger will provide synergistic benefits. Thus, in the attempt to provide merging cooperatives with additional information to enable more effective performance of the postmerger decisions and activities, this chapter categorizes the activities critical to effective merger completion and elaborates on their performance as recommended by the case merger.

Congruent with the simplification and control objectives of the KPA's, the purpose of this chapter will be accomplished through a classification procedure of the critical postmerger activities together with a normative discussion of activity performance. Three stages of activity objectives are specified denoting three different time periods (see Table 7). Activities not specifically performed by the case merger but included in the prescriptive network are also denoted within the classification scheme. Emphasis will be on those activities which are prescribed but not included in the descriptive network, by providing an example of a unique prescriptive activity within each stage.

Table 7. Stages of Activity Performance.

KPA	Stage I: To Generate Information	Stage II: To Facilitate Coordination	Stage III: To Facilitate Synergy
Accounting	devise branch manual computerize accounting	combined financial statements	branch and route financial statements
Marketing	determine advertising procedures sales training sessions review present pricing & credit policies	reorganize sales routes adjust pricing, credit, and advertising procedures	
Personnel	determine employees needed branch manager selection obtain personnel records	adjust manpower needs unify personnel policies standard benefit plans	implement safe driving program
Production	production meeting review premerger production	adjust production areas	implement results of efficiency study
Transportation	vehicle survey	adjust vehicle and maintenance facilities	
Engineering	inventory of facilities and equipment	adjust facilities, equipment and operating procedures	adjust utility utilization procedures
Procurement	member meetings	adjust hauling rates	
Purchasing	determine purchasing procedures	coordinate purchasing	

### Stage 1: To Generate Information

Adequate information provided during the early stages of merger is necessary to enable the successful execution of subsequent decisions and activities. The formulation of the branch manual is an example of such a procedure. The branch manual should be formulated during the early stages of merger and its methods operating effectively prior to the legally effective date of merger. Furthermore, educational sessions should be periodically conducted to ensure effective implementation of the specified procedures. Another example--computerization of accounting--is critical because of the information demands of the other KPA's. A priority of activities to be computerized should be specified and consistent with the firm's goals and potential payoffs. This activity should be completed as rapidly as possible so as not to delay the completion of subsequent activities.

A final example--Branch Manager selection--is important to the achievement of effective utilization of information. It is of utmost importance that the Branch Manager have a favorable outlook toward the merger. If the Branch Manager is biased against the merger, the information relayed by him may be selective, that is, in opposition to effective merger decisions. The selection of the Branch Manager would logically be to place the General Manager

of the "acquired" cooperative in the Branch Manager position.

However, this may not always be advantageous.

The method of selecting the Branch Manager should be determined during the premerger discussions. However, actual selection should not take place until the early stages of the postmerger period. Such a scheduling procedure may ensure more support of the "acquired" General Manager throughout the negotiation period.

Competent management is potentially available at the "acquired" firm; however, the Manager willing to wholeheartedly cooperate during the postmerger decision period is rare as indicated by the following:

The main problem faced by experienced firms after the merger is that of integrating the entrepreneur into the system. This is difficult because the entrepreneur is accustomed to running his own show and cannot easily shift his way of thinking to where he has to submit his ideas for someone else to approve. (Grossack, 1939, p. 56)

If the General Manager of the acquired cooperative is converted to the Branch Manager problems inherently arise. First, the General Manager appointed as Branch Manager is likely to resist change and operate as before merger. The purpose of merger, however, is to breathe new life into an organization;

thus, if the cooperatives remain independently operated, no synergies will be obtained. Also, the former General Manager may now have a less prestigious position and thus may resent proposed changes. The Branch Manager's attitude is critical because it permeates the entire branch.

One alternative is to dismiss the General Manager of the "acquired" cooperative. However, despite the difficulties involved in conducting the Branch Manager selection, attempts should be made to retain these valuable individuals. The determination of the former General Manager's future position should be given careful consideration. A more desirable alternative would be to relocate them within the cooperative when it is determined what the total organizational needs are, and the extent to which they can be met by these individuals.

In any event, some course of action should be taken to provide the former General Manager of the "acquired" cooperative with at least some short-term security and thus assure the members of the merged association will, to the extent feasible, have the benefit of his experience and ability. Such a procedure would eliminate much of the personnel and member dissension during the uncertain postmerger decision period.

## Stage II: To Facilitate Coordination

In order to prevent firms from operating autonomously after merger, many activities must be initiated to provide for an efficiently coordinated firm. Dissimilar policies and practices of the merging firms should be standardized to create unity of operations; in view of the fact that, effective coordination of policies and practices is a prerequisite to the achievement of synergy.

The activity of adjusting pricing, credit, and advertising policies provides an example that facilitates coordination. If the pricing, credit, and advertising policies are not effectively standardized, employee and customer dissension is likely to arise, distracting from the favorable image objective. Also, if the pricing and credit policies are not immediately standardized the cooperatives tend to remain operating autonomously which impairs potential synergistic benefits. Thus, an accurate appraisal of advertising procedures should be an early objective of the marketing department. If this ability does not exist within the cooperative, a professional advertising agency should be consulted to provide an objective analysis of the current advertising expenditures of the constituent cooperatives. Such an appraisal will facilitate expenditure coordination.

### Stage III: To Facilitate Synergy

The degree of synergy resulting from combining two or more firms may result primarily from the integration of a few selected activities. In general, the major components of synergy result from the successful completion of the coordination activities in Stage II. However, the coordination activities alone may not produce the desired synergistic benefits; many of the coordination activities need extensions as a means of facilitating synergy. The activity of implementing the results of a production efficiency study will serve as an example.

The conduct of production efficiency study and implementation of its recommended changes will facilitate the potential synergistic benefits of merger. In general, the efficiency study should be conducted with similar criteria as the premerger feasibility study, although generally more complete information is available. Moreover, such a study should consider costs of production for each product and alternative production locations if this analysis was not included in the merger feasibility study. The production people should be informed after the original recommended adjustments have been made that an efficiency study will be conducted within a specified period of time. Throughout the postmerger period actual production performance should be compared to desired performance; and, if the desired performance is not

attained within the specified time period as determined by the efficiency study, action should be taken to provide greater production efficiency. Such a procedure is congruent with Garoian and Haseley's (1963c) concept of control.

The performance of the activities in the above classification scheme are not definitively confined to their respective Stages, but rather considerable overlapping exists among them. Thus, the classification scheme provides only a means of conceptualizing the unification process in three different time periods. Furthermore, the attempt was made to emphasize the prescriptive activities not included in the descriptive network via example.

## V. SUMMARY AND CONCLUSIONS

Performing postmerger decisions and activities is a non-programmed project conducted under conditions of imperfect knowledge. Consequently, cooperatives merging for the first time lack the experience that a prior merger would have provided. Therefore, it was the purpose of this study to provide inexperienced cooperatives with a guide for scheduling uncertain postmerger decisions and activities. Such a guide will provide the inexperienced cooperative with additional information to enable more rational postmerger decision making.

The necessary historical and prescriptive information was obtained from an actual case merger. The case study method was used for pedagogical reasons. Hopefully, by using this approach the results are more readily adaptable in practical use than if a purely theoretical design were used. The specific case consisted of the merger of five dairy cooperatives.

### Descriptive Analysis

In attempting to deal with a large number of events a means of simplification and classification was employed. This was accomplished by identifying the key performance areas (KPA) of the

constituent cooperatives (e. g., marketing, accounting, personnel, etc.) and specifying the sub-goal within each area.

Subsequent to KPA specification, all of the nonrecurrent events were identified and presented in a descriptive network. Such a network showed the sequence of event occurrences, their interrelationships, and interdependencies. Following is a summary of each KPA of the case merger. The KPA's are discussed with respect to their postmerger responsibilities, their sub-goals, and their position in the descriptive network.

Two simultaneous activity paths led to the sub-goal--centralized accounting--within the accounting area. The first consisted of computerizing the accounting area. The second essentially consisted of combining the books of the constituent cooperatives together with reporting a financial summary for performance evaluation. Basically, the postmerger responsibility of the accounting area was to provide accurate and timely decision making information for use by the other KPA's.

The sub-goal of the marketing area was to create a favorable merger image while providing uniform pricing, credit and advertising procedures among the constituent cooperatives. The essential activities that were scheduled leading to this objective were: reorganization of sales routes, review and adjust the pricing, credit, and advertising procedures and conduct sales training sessions. The sales training sessions were performed simultaneously with

the other activities.

The sub-goal of the personnel area consisted of two parts: 1) to standardize all personnel information, and 2) to adjust manpower needs. Both parts were performed simultaneously. The essential activities of the first part consisted of obtaining personnel records and standardizing personnel policies and benefit plans. The second part, and more uncertain, was essentially concerned with determining and adjusting the manpower needs. The latter path was troublesome because of the resistance to change element among the personnel, viz., Branch Managers.

The sub-goal of the production area was to provide efficiently adjusted production. The attainment of this sub-goal was critical, since by its completion more efficient production was achieved, thus contributing to the potential synergistic benefits. The adjustments taken by the case merger closely followed the recommended changes of the feasibility study.

The primary responsibility of the transportation area was to provide economic transportation. This sub-goal was reached through a process of reviewing and adjusting the vehicles and maintenance facilities of the constituent cooperatives. The effective execution of these activities depended to a large extent on the route reorganization completion by the sales and procurement departments.

The engineering area was primarily responsible for the physical adjustments to the facilities and equipment. The activities that were performed by the case merger included: inventory of the facilities and equipment, adjustments to the facilities and equipment, and standardization of the procedures on equipment use. The completion of the engineering sub-goal--physical production techniques adjusted--was largely dependent upon the recommended changes in specializing and concentrating the production processes.

The responsibility of the procurement area following merger was to adjust the hauling routes and rates and inform the member patrons of the progress and effects of the merger. These activities led to the procurement sub-goal of employing the new hauling rates. The performance of the procurement activities were focused on creating a favorable image.

Two activities lie on the sequential path of the purchasing area--determine premerger purchases, and centralize and coordinate the purchases of the constituent cooperatives. The attainment of the sub-goal--centralized and coordinated purchases--was largely dependent upon accurate and timely accounting information.

The above information was extracted from the descriptive network which diagrammatically presented the actual procedure taken by the case merger. However, contrary to the requirements of network construction, perhaps the most important element

affecting the completion of the case's postmerger activities were the "people problems" encountered. These "problems" represent the Achilles' heel of postmerger decision making; and, just as their effects are nonquantifiable so must be their solution.

### PERT Analysis

In attempting to provide a guide for merging cooperatives to follow, the analytical technique of PERT was employed.<sup>13/</sup> Consistent with the purpose of this thesis, the application of the PERT technique provides results that allow for improved information for decision making. However, the PERT technique does not make decisions; it is only a tool that can be used as an indicator to provide the decision maker with additional information to enable more rational decisions. Furthermore, the validity of the PERT results is based on the supposition that time is a critical factor in project completion. Thus, by using PERT, the results of this study is based on the supposition that a rapid completion of the postmerger activities will augment the synergistic benefits.

The PERT technique determined the critical path to be within the marketing and personnel areas. Four activities were on the

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<sup>13/</sup> For a detailed explanation of PERT see Chapter I.

critical path: determination of advertising procedures, reorganization of sales routes, determination of employees needed, and adjustments to personnel needs. Based on the activity completion time estimates provided by the case study, this sequence of activities is expected to take the longest time (14 months); thus, delay in any of the critical path activities will delay the completion date of merger.

### In Conclusion

The findings of this study do not provide a theory for unification, but rather a teaching device to be used by merging cooperatives. The findings of this study were based on a dairy cooperative unification project and thus are specifically oriented towards scheduling the decisions and activities of a dairy cooperative merger. A unification project involving cooperatives engaged in another commodity or performing different functions is likely to require different decisions and activities; however, the scheduling methods used in this study are interchangeable. The information presented should be modified to fit the particular merger situation.

The findings also contribute to the limited information available to farmer cooperatives contemplating unification. This study and a previous study by Wentzel (1968c), provide valuable information to unifying cooperatives regardless of the form of unification--merger or consolidation.

## BIBLIOGRAPHY

- Bain, Joe S. 1968. Industrial organization. New York, John Wiley and Sons. 673 p.
- Berry, Calvin R. 1968. Discussion: merger component of growth of agricultural cooperatives. American Journal of Agricultural Economics 50:1483-1484.
- Buzzell, Robert D. and Charles C. Slater. 1962. Decision theory and marketing management. Journal of Marketing 26(3):7-16.
- Byerlee, D. R. 1968. A decision theoretical approach to the economic analysis of information. Master's thesis. Armidale, N.S.W. University of New England. 140 numb. leaves.
- Dewey, John. 1933. How we think. New York, D. C. Heath. 301 p.
- Dewing, A. S. 1921. A statistical test of the success of consolidations. Quarterly Journal of Economics 36:86-101.
- Duft, Ken D. 1970. PERT time/cost: an aid to agribusiness management. Pullman, Washington State University, Cooperative Extension Service. 65 p.
- Federal Electric Corporation. 1963. A programmed introduction to PERT. New York, John Wiley and Sons. 145 p.
- Garoian, Leon and Arnold F. Haseley. 1965. Developing planning information for agricultural marketing firms. Corvallis. 84 p. (Oregon State University. Cooperative Extension Service)
- \_\_\_\_\_ 1963. The board of directors in agricultural marketing firms. Corvallis. 141 p. (Oregon State University. Cooperative Extension Service)
- Garoian, Leon and Gail Cramer. 1969. Cooperative mergers: their objectives, success, and impact on growth. Corvallis. 22 p. (Oregon State University. Agricultural Experiment Station. Bulletin 605)

- Gray, Clifford F. 1968. PERT simulation: a dynamic approach to the PERT technique. Working paper no. 12. Corvallis, Oregon State University, School of Business and Technology. 20 numb. leaves.
- Grossack, Irvin. 1969. Discussion: mergers and managers. Proceedings of the 29th annual meeting. Academy of Management, Journal, 1969, p. 55-57.
- Halter, A. N. and G. W. Dean. 1969. Decisions under uncertainty with research applications. Oregon State University. 292 p. (In press)
- Heller, Frank A. 1960. The use of case studies at a technical college. In: Case study practice. [London], British Institute of Management. 53 p.
- Hicks, J. R. and R. G. D. Allen. 1934. A reconsideration of the theory of value. *Economica* 1:52-76, 196-219.
- King, William R. 1968. Probability for management decisions. New York, John Wiley and Sons. 372 p.
- Kitching, John. 1967. Why do mergers miscarry? *Harvard Business Review* 45(6):84-101.
- Kotler, Philip. 1967. Marketing management: analysis, planning, and control. Englewood Cliffs, New Jersey, Prentice-Hall. 628 p.
- Levin, Richard I. and Charles A. Kirpatrick. 1966. Planning and control with PERT/CPM. New York, McGraw Hill. 179 p.
- Levitt, Theodore. 1962. Innovation in marketing: new perspectives for profit and growth. New York. McGraw Hill. p. 43-50, 54-71.
- Livermore, Shaw. 1935. The success of industrial mergers. *Quarterly Journal of Economics* 10:68-96.
- Loomis, Carol J. 1966. The 500: a decade of growth. *Fortune* 74(2):213-215, 268-278.

- Luce, Duncan R. and Howard Raiffa. 1957. Games and decisions. New York, John Wiley and Sons. 509 p.
- Mather, J. Warren. 1966. Practical paths to "people problems" in mergers. News for Farmer Cooperatives 33:7-8, 18.
- Mead, Edward S. 1923. Corporate finance. New York, D. Appleton. 480 p.
- Miller, David W. and Martin K. Starr. 1960. Executive decisions and operations research. Englewood Cliffs, New Jersey, Prentice-Hall. 446 p.
- Miller, Robert W. 1962. How to plan and control with PERT. Harvard Business Review 40(2):2, 93-104.
- Mueller, Willard F. 1966. The role of mergers in the growth of agricultural cooperatives. Berkeley. 66 p. (California. Agricultural Experiment Station. Bulletin 777)
- Reid, Samuel, et al. 1966. Growing from within may pay off faster. Business Week, 1933, p. 44-46.
- Reid, Samuel. 1969. Is merger the best way to grow? Business Horizons 12(1):41-50.
- Schlaifer, Robert. 1959. Probability and statistics for business decisions. New York, McGraw Hill. 732 p.
- Searby, Fredwick W. 1969. Control postmerger change. Harvard Business Review 47(5):4-12, 154-155.
- Short, Robert. 1967. Business mergers: how and when to transact them. Englewood Cliffs, New Jersey, Prentice-Hall. 209 p.
- Stern, Louis W. 1969. Mergers under scrutiny. Harvard Business Review 47(4):18-36.
- Stevenson, E. V. 1968. Questions after merger. News for Farmer Cooperatives 35(2):8.
- Swanson, Bruce L. 1969. Cooperative business trend still up. News for Farmer Cooperatives 36(17):14-16.
- U. S. D. A. 1969. Farmer cooperative business tops \$17 billion. Washington, D. C. (U. S. D. A. newsletter no. 2179-69) 4 p.

vonNeumann, J. and O. Morgenstern. 1944. Theory of games and economic behavior. Princeton, Princeton University Press. 625 p.

Wentzel, Roland K. 1968. Unification decisions of a cooperative consolidation. Master's thesis. Corvallis, Oregon State University. 120 numb. leaves.

Weston, Fred J. 1953. The role of merger in the growth of large firms. Berkeley, University of California Press. 159 p.

## APPENDICES

## APPENDIX A

The Ex Post Results of the Case Dairy  
Cooperative Merger

As indicated in Chapter I, the overall objective of merger is to attain some type of synergy, despite evidence supporting an approximate .50 probability of actual achievement. More specifically, the ex ante objectives of the case merger were: 1) to achieve economies of size, 2) to achieve economies of scale,<sup>14/</sup> 3) to acquire competent management personnel, and 4) to acquire facilities. In short, the first two objectives were attained, whereas the latter two were not achieved to the extent desired.

In general, economies of size are likely to occur largely as:  
1) economies of large-scale management, 2) economies of large-scale distribution and/or 3) pecuniary economies of large-scale

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<sup>14/</sup> Economies of scale arise if, at constant input prices, a proportional increase in input yields a greater than proportional expansion in output; thus, the cost per unit of output is reduced by expanding "up to a point" the size of plant.

In addition to reducing cost per unit of output by expanding plant output, the firm may also find that costs can be somewhat reduced by growing large enough to operate two or more "optimal-scale" plants. Thus, in addition to economies of scale, these economies are designated economies of size and may take one of several forms. Both scale and size economies are highly interrelated and their availability depends upon the internal and external environment of each constituent entity.

purchasing (Bain, 1968b). All three economies were achieved to varying degrees in the case merger together with substantial economies of large-scale accounting.

Economies of scale are attained as a result of decreased per unit costs as the plant expands output. In the case, economies of scale were achieved because the more specialized plants were able to exploit mass production techniques that involved: 1) the specialization of labor, 2) the use of specialized machinery and other capital equipment, and 3) the specialization of management and supervisory personnel. Thus, throughout the program of specialization and concentration of production economies of scale were encountered from expanding output, resulting in reduced average total costs.

Upon analysis of accounting data prior and subsequent to merger, average total cost decreased from 9.4 cents per pound of whole milk to 8.8 cents per pound for whole milk, representing a 6.8 percent decrease in average total cost.<sup>15/</sup> This decrease occurred as output expanded. However, the total effect cannot be entirely contributed to the achievement of scale economies nor can it be contributed to economies of size. Given the available accounting data, the precise contribution of each to the decreased

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<sup>15/</sup> Total costs were deflated using the wholesale price index (1957-59 = 100).

costs cannot be determined; however, the achievement of both objectives were realized subsequent to merger.

The ex ante objective of acquiring competent management personnel was not achieved to the extent desired. Despite the acquisition of a number of technical people, the much desired management personnel were not acquired, largely because they did not exist in the constituent cooperatives.

The physical condition of the facilities acquired during a unification project can substantially affect the degree of synergy obtained following merger. Prior to the decision to merge, the acquiring cooperatives' knowledge of the "acquired" cooperative's facilities was largely based on a review of their individual balance sheets. However, as realized after merger, decisions based solely on accounting data should not be substituted for an objective physical appraisal when complex manufacturing plants and equipment are involved. Such a course of action did not detect the actual facility condition; thus resulting in only partial achievement of the acquiring of facilities objective.

Notwithstanding the three-year period required to move through the integration maze and a multitude of problems encountered throughout the course, the ex post results of the case merger verify a successful merger. Thus, in spite of the .50 probability of success, the marriage of four Oregon and one Washington dairy resulted in a degree of synergy.

## APPENDIX B

PERT Simulation

Gray (1968a) believes that the standard PERT approach does not adequately cope with the uncertainty and instability associated with the estimates of activity times and the resultant determination of project completion time. The actual activity duration time is expected to occur between the pessimistic and optimistic time estimates (and in rare cases may actually go beyond these extremes). However, as the activity time varies within this range it may have an effect on the entire network of interrelated activities, even to the extent of completely altering the critical path configuration. The standard PERT technique does not allow for the possibility of the critical path to change. In projects with several paths having project duration times that are nearly the same length, the probability of the critical path shifting to other paths is high. In a real project situation which has several closely timed critical paths, the actual critical path may switch back and forth between the paths many times during the actual course of the project work (Gray, 1968b).

PERT simulation (PS) does, however, account for the fact that the actual duration time associated with each activity is some value lying within the range between optimistic and pessimistic

time estimates but with some form of probability distribution over the range rather than being only a specified deterministic value. PS incorporates this variance or element of uncertainty dynamically into the analysis. By simulating this variance the PS model reveals, in advance, the likelihood of shifting critical paths. If the likelihood of several closely timed paths to become critical paths is high, the network is termed "sensitive." If the likelihood of the critical paths to shift is low the network is "insensitive." (Gray, 1968c)

If, in our analysis, the network is found to be sensitive, then PS will provide a multitude of additional information over that provided by the standard PERT technique. If, however, the network is found to be insensitive, the results of PS and the standard PERT will be identical.

#### Results of PERT Simulation

Application of PS indicates a relatively sensitive network, that is, the critical path configuration is likely to change as the actual activity time varies between the optimistic and pessimistic time estimates. The value of knowing this information prior to starting the project is that those activities maintaining high probabilities of becoming critical can be closely monitored to reduce the incidence of bottlenecks not detected by the standard

PERT technique (Gray, 1968d). In many projects there is a tendency for management to direct attention primarily to the critical path. However, if the network is found to be sensitive, such a course of action can result in costly errors from resource misallocation. Thus, the major value of PS is that it alerts management to potential bottlenecks not ostensible from the standard PERT technique.

The results of PS reveal eight unique critical paths. Hence, the apparently insensitive network has been disclosed to be relatively sensitive. The critical path having the highest probability of becoming critical was, indeed, the identical path calculated by the standard PERT technique; however, its probability of being the critical path is only 55%. The probabilities of the seven remaining paths becoming critical and their constituent activities are conveniently summarized in Appendix Table 6.

The above data, by itself, does not provide sufficient information to guide the cooperative in implementing specific scheduling action to anticipate bottlenecks in the prescriptive network. However, PS provides additional information in identifying critical points for management attention.

From Appendix Table 7 it can be seen that 37 activities are never critical whereas 22 activities are likely to be on the critical path. This information provides the cooperative with specific quantitative data of the critical points prior to the conduction of

the postmerger activities. Thus, specific courses of action can be pinpointed and formulated prior to the start of merger. In any event, both standard PERT and PS can provide cooperative management with valuable information prior to the performance of a unification project.

Appendix Table 1. Input Data List.

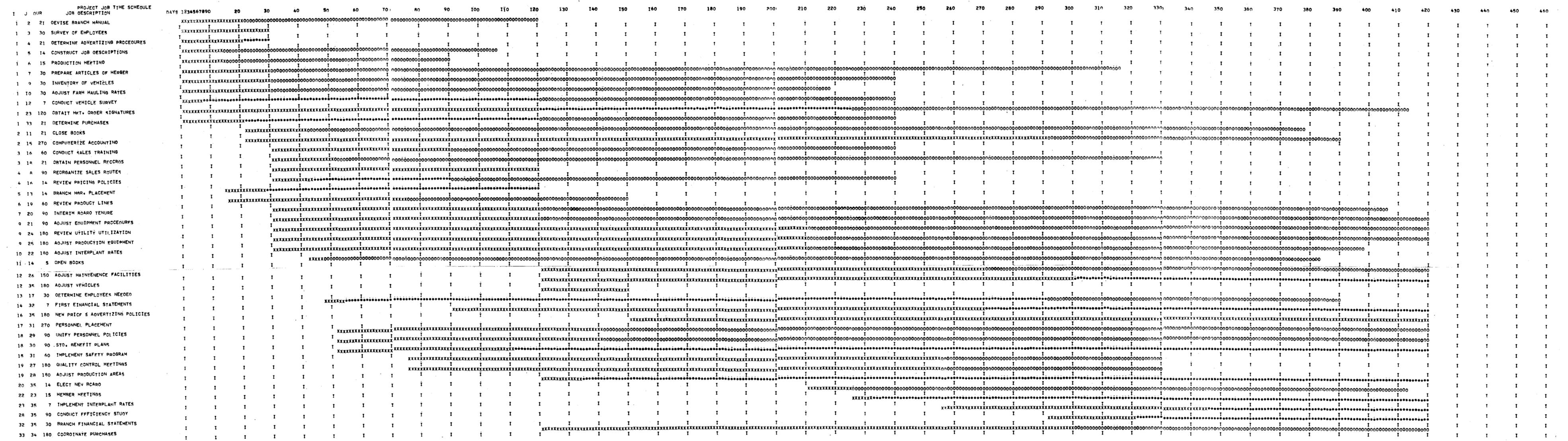
NO.	I	J	DUR	MTN	MAX	NYCODE	COMMENTS
1	1	2	21	7	60	1	DEVELOP BRANCH MANUAL
2	1	3	30	15	90	1	SURVEY OF EMPLOYEES
3	1	4	21	14	30	1	DETERMINE ADVERTIZING PROCEDURES
4	1	5	14	3	30	1	CONSTRUCT JOB DESCRIPTIONS
5	1	6	15	1	30	1	PRODUCTION MEETING
6	1	7	30	7	45	1	PREPARE ARTICLES OF MERGER
7	1	9	30	14	60	1	INVENTORY OF VEHICLES
8	1	10	30	10	120	1	ADJUST FARM HAULING RATES
9	1	12	7	5	15	1	CONDUCT VEHICLE SURVEY
10	1	23	120	30	320	1	OBTAIN Mkt. ORDER SIGNATURES
11	1	33	21	7	45	1	DETERMINE PURCHASES
12	2	11	21	7	30	1	CLOSE BOOKS
13	2	15	270	30	360	1	COMPUTERIZE ACCOUNTING
14	3	4	0	0	0	1	DUMMY
15	3	16	60	30	120	1	CONDUCT SALES TRAINING
16	3	18	21	7	30	1	OBTAIN PERSONNEL RECORDS
17	4	8	90	30	180	1	REORGANIZE SALES ROUTES
18	4	16	14	7	30	1	REVIEW PRICING POLICIES
19	5	13	14	5	30	1	BRANCH MGR. PLACEMENT
20	6	19	60	30	90	1	REVIEW PRODUCT LINES
21	7	20	90	30	180	1	INTERIM BOARD TENURE
22	8	12	0	0	0	1	DUMMY
23	8	13	0	0	0	1	DUMMY
24	9	14	0	0	0	1	DUMMY
25	9	21	90	30	180	1	ADJUST EQUIPMENT PROCEDURES
26	9	24	180	30	360	1	REVIEW UTILITY UTILIZATION
27	9	25	180	30	360	1	ADJUST PRODUCTION EQUIPMENT
28	9	33	0	0	0	1	DUMMY
29	10	22	180	30	360	1	ADJUST INTERPLANT RATES
30	11	14	5	1	10	1	OPEN BOOKS
31	12	26	150	30	360	1	ADJUST MAINTENANCE FACILITIES
32	12	33	0	0	0	1	DUMMY
33	12	35	180	60	360	1	ADJUST VEHICLES
34	13	17	30	10	45	1	DETERMINE EMPLOYEES NEEDED
35	14	32	7	1	30	1	FIRST FINANCIAL STATEMENTS
36	15	32	0	0	0	1	DUMMY
37	15	34	0	0	0	1	DUMMY
38	16	35	180	60	360	1	NEW PRICE & ADVERTIZING POLICIES
39	17	31	270	180	360	1	PERSONNEL PLACEMENT
40	18	29	90	30	180	1	UNIFY PERSONNEL POLICIES
41	18	30	90	30	360	1	STD. BENEFIT PLANS
42	18	31	60	30	90	1	IMPLEMENT SAFETY PROGRAM
43	19	27	180	30	220	1	QUALITY CONTROL MEETINGS
44	19	28	180	90	360	1	ADJUST PRODUCTION AREAS
45	20	35	14	1	30	1	ELECT NEW BOARD
46	21	25	0	0	0	1	DUMMY
47	22	23	15	1	30	1	MEMBER MEETINGS
48	23	35	7	1	14	1	IMPLEMENT INTERPLANT RATES
49	24	25	0	0	0	1	DUMMY
50	25	35	0	0	0	1	DUMMY
51	26	35	0	0	0	1	DUMMY
52	27	28	0	0	0	1	DUMMY
53	28	35	90	60	180	1	CONDUCT EFFICIENCY STUDY
54	29	31	0	0	0	1	DUMMY
55	30	31	0	0	0	1	DUMMY
56	31	35	0	0	0	1	DUMMY
57	32	35	30	7	90	1	BRANCH FINANCIAL STATEMENTS
58	33	34	180	60	270	1	COORDINATE PURCHASES
59	34	35	0	0	0	1	DUMMY

Appendix Table 2. Standard CPM Analysis.

I	J	DUR	EST	LSY	EFT	LFT	TF	
1	2	21	1	99	21	120	99	0
1	3	30	1	0	30	30	0	0 CRITICAL
1	4	21	1	9	21	30	9	9
1	5	14	1	92	14	106	92	0
1	6	15	1	75	15	90	75	0
1	7	30	1	286	30	316	286	0
1	9	30	1	210	30	240	210	0
1	10	30	1	188	30	218	188	0
1	12	7	1	233	7	240	233	113
1	23	120	1	293	120	413	293	105
1	33	21	1	219	21	240	219	99
2	11	21	22	357	42	378	336	0
2	15	270	22	120	291	390	99	0
3	4	0	31	30	30	30	0	0 CRITICAL
3	16	60	31	180	90	240	150	0
3	18	21	31	309	51	330	279	0
4	8	90	31	30	120	120	0	0 CRITICAL
4	16	14	31	226	44	240	196	46
5	13	14	15	106	28	120	92	92
6	19	60	16	90	75	150	75	0
7	20	90	31	316	120	406	286	0
8	12	0	121	240	120	240	120	0
8	13	0	121	120	120	120	0	0 CRITICAL
9	14	0	31	383	30	383	353	17
9	21	90	31	330	120	420	300	0
9	24	180	31	240	210	420	210	0
9	25	180	31	240	210	420	210	0
9	33	0	31	240	30	240	210	90
10	22	180	31	218	210	398	188	0
11	14	5	43	378	47	383	336	0
12	26	150	121	270	270	420	150	0
12	33	0	121	240	120	240	120	0
12	35	180	121	240	300	420	120	120
13	17	30	121	120	150	150	0	0 CRITICAL
14	32	7	48	383	54	390	336	237
15	32	0	292	390	291	390	99	0
15	34	0	292	420	291	420	129	9
16	35	180	91	240	270	420	150	150
17	31	270	151	150	420	420	0	0 CRITICAL
18	29	90	52	330	141	420	279	0
18	30	90	52	330	141	420	279	0
18	31	60	52	360	111	420	309	309
19	27	180	76	150	255	330	75	0
19	28	180	76	150	255	330	75	0
20	35	14	121	406	134	420	286	286
21	25	0	121	420	120	420	300	90
22	23	15	211	398	225	413	188	0
23	35	7	226	413	232	420	188	188
24	25	0	211	420	210	420	210	0
25	35	0	211	420	210	420	210	210
26	35	0	271	420	270	420	150	150
27	28	0	256	330	255	330	75	0
28	35	90	256	330	345	420	75	75
29	31	0	142	420	141	420	279	279
30	31	0	142	420	141	420	279	279
31	35	0	421	420	420	420	0	0 CRITICAL
32	35	30	292	390	321	420	99	99
33	34	180	121	240	300	420	120	0
34	35	0	301	420	300	420	120	120

OCRITICAL PATH I.D. NO. = (110015.857), TOTAL PROJECT TIME ON CRITICAL PATH = 420

Appendix Table 3. Bar Chart.



Symbol Legend:  
 X = Job day when work is being done on job.  
 \* = Activity free slack-maximum time by which actual completion can be greater than earliest expected time of an activity without any effect on other activities or events.  
 0 = Total activity slack-maximum time by which actual completion can be greater than earliest time of an activity without having an effect on the overall project duration.

Appendix Table 4. Simulation Analysis Results.

LIST OF CRITICAL PATHS..I.D. NO. (UNIQUE SERIAL NO.)  
 CRITICAL JOBS ON PATH...IJ NO. (ESTIMATED JOB TIME GIVEN)

CRITICAL PATH I.D. NO. 1 (125021.000)  
 10002 ( 21), 20015 ( 270), 150032 ( 0), 320035 ( 30),

CRITICAL PATH I.D. NO. 2 (110015.857)  
 10003 ( 30), 30004 ( 0), 40008 ( 90), 80013 ( 0), 130017 ( 30), 170031 ( 270), 310035 ( 0),

CRITICAL PATH I.D. NO. 3 ( 56012.400)  
 10003 ( 30), 30004 ( 0), 40008 ( 90), 80012 ( 0), 120035 ( 180),

CRITICAL PATH I.D. NO. 4 (135022.000)  
 10006 ( 15), 60019 ( 60), 190028 ( 180), 280035 ( 90),

CRITICAL PATH I.D. NO. 5 ( 66684.667)  
 10003 ( 30), 30016 ( 60), 160035 ( 180),

CRITICAL PATH I.D. NO. 6 ( 90014.667)  
 10003 ( 30), 30004 ( 0), 40008 ( 90), 80012 ( 0), 120026 ( 150), 260035 ( 0),

CRITICAL PATH I.D. NO. 7 (123351.333)  
 10004 ( 21), 40008 ( 90), 80013 ( 0), 130017 ( 30), 170031 ( 270), 310035 ( 0),

CRITICAL PATH I.D. NO. 8 (102017.000)  
 10004 ( 21), 40008 ( 90), 80012 ( 0), 120026 ( 150), 260035 ( 0),

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 STAN THOMPSON

Appendix Table 5. Simulation Analysis Summary.

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X-BAR-RAP....MEAN OF SET MEANS FOR PROJECT COMPLETION TIME =	463.6
STANDARD ERROR OF THE ARITHMETIC MEAN FOR PROJECT COMPLETION TIME =	13.1
RANGE OF MEANS =	36. MAX. = 481, MIN. = 446

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Appendix Table 6. Analysis of Critical Paths from Simulation.

NUMBER OF CRITICAL PATHS RESULTING = 8

CRITICAL PATH I.D.NO.	NO. OF ACTIVITIES	NO. TIMES CRITICAL	PROBABILITY	AVERAGE TOTAL TIME
1	4	3	.030	417.2
2	7	55	.550	468.9
3	5	9	.090	445.3
4	4	23	.230	472.7
5	3	2	.020	447.4
6	6	6	.060	439.3
7	4	1	.010	470.4
8	5	1	.010	436.1

Appendix Table 7. Analysis of Project Network Job Activities.

ACTIVITY I	ACTIVITY J	PROBABILITY CRITICAL	AVERAGE VALUES FOR ACTIVITY TIMES					FLCAT
			DUR	FS	LS	EF	LF	
10002		.030	29.1	0	151.5	29.1	180.7	151.5
10003		.720	44.1	0	14.3	44.1	58.4	14.3
10004		.020	21.6	0	38.6	21.6	60.2	38.6
10005		0	15.7	0	134.1	15.7	149.8	134.1
10006		.230	14.5	0	60.1	14.5	74.7	60.1
10007		0	26.0	0	328.1	26.0	354.0	328.1
10009		0	33.6	0	187.4	33.6	221.0	187.4
10010		0	50.9	0	188.4	50.9	239.3	188.4
10012		0	9.1	0	206.6	9.1	215.7	206.6
10023		0	154.8	0	301.6	154.8	456.4	301.6
10037		0	25.2	0	271.3	25.2	296.5	271.3
20011		0	18.9	29.1	384.5	48.0	403.4	355.4
20015		.030	240.7	29.1	180.7	269.9	421.4	151.5
30004		.700	0	44.1	60.2	44.1	60.2	16.1
30016		.020	65.4	44.1	197.7	109.5	243.1	153.6
30018		0	20.3	44.1	263.2	64.4	283.5	219.1
40008		.720	99.5	44.3	60.4	143.8	159.9	16.1
40016		0	17.9	44.3	245.2	62.2	263.1	200.9
50013		0	15.8	15.7	149.8	31.5	165.6	134.1
60019		.230	58.1	14.5	74.7	72.7	132.8	60.1
70020		0	93.6	26.0	354.0	119.6	447.6	328.1
80012		.160	0	143.8	215.7	143.8	215.7	71.9
80013		.560	0	143.8	165.6	143.8	165.6	21.8
90014		0	0	33.6	409.0	33.6	409.0	375.4
90021		0	103.7	33.6	359.9	137.3	463.6	326.3
90024		0	187.0	33.6	276.6	220.5	443.6	243.0
90025		0	216.7	33.6	246.8	250.3	463.6	213.2
90033		0	0	33.6	296.5	33.6	296.5	262.9
100022		0	200.7	50.9	239.3	251.4	440.0	188.4
110014		0	5.4	48.0	403.4	53.6	409.0	355.4
120026		.070	205.3	143.8	258.2	349.1	463.6	114.5
120033		0	0	143.8	296.5	143.8	296.5	192.7
120035		.090	195.1	143.8	268.5	338.8	463.6	124.7
130017		.560	28.6	143.8	165.6	172.4	194.2	21.8
140032		0	12.4	54.1	409.0	66.6	421.4	354.8
150032		.030	0	269.9	421.4	269.9	421.4	151.5
150034		0	0	269.9	463.6	269.9	463.6	193.7
160035		.020	200.4	109.5	263.1	309.9	463.6	193.6
170031		.560	269.4	172.4	194.2	441.8	463.6	21.8
180020		0	99.7	64.4	363.9	164.1	463.6	299.4
180030		0	171.7	64.4	291.9	236.1	463.6	227.4
180031		0	61.2	64.4	402.3	125.6	463.6	337.9
190027		0	145.1	72.7	208.7	217.7	353.7	136.0
190028		.230	215.4	72.7	138.3	288.1	353.7	65.6
200035		0	15.9	119.6	447.6	135.5	463.6	328.1
210025		0	0	137.3	463.6	137.3	463.6	326.3
220023		0	16.4	251.6	440.0	268.0	456.4	188.4
230035		0	7.2	274.5	456.4	281.7	463.6	181.9
240025		0	0	220.5	463.6	220.5	463.6	243.0
250035		0	0	270.6	463.6	270.6	463.6	193.0
260035		.070	0	349.1	463.6	349.1	463.6	114.5
270028		0	0	217.7	353.7	217.7	353.7	136.0
280035		.230	109.8	293.6	353.7	403.4	463.6	60.1
290031		0	0	144.1	463.6	164.1	463.6	299.4
300031		0	0	236.1	463.6	236.1	463.6	227.4
310035		.560	0	442.3	463.6	442.3	463.6	21.3
320035		.030	42.1	269.9	421.4	312.0	463.6	151.5
330034		0	167.1	143.8	296.5	310.8	463.6	152.7
340035		0	0	327.6	463.6	327.6	463.6	135.9