Pert-cpm and transportation problem technique

CHAPTER I INTRODUCTION BACKGROUND OF THE STUDY The IIMMPC is a producer’s cooperative composed of small scale manufacturers from Iligan City and Lanao del Norte. It was organized in 2007 to enable the members to engage in big projects that cannot be done singly by any member cooperators but only through the joint efforts of all the member-cooperators. The members of the cooperative come from the different sectors of manufacturing business. These include the food sector, the gift, toys and housewares (GTH) sector, the bamboo products sector and the furniture sector. n 2007, the IIMMPC through the furniture sector participated in the bidding for the supply of various school furnitures for the Department of Education of Region 10. The IIMMPC got the project at the winning bid of about P3, 000, 000. 00. The duration of the project was 90 calendar days. The work was divided by the six furniture makers of the cooperative. In 2008, the IIMMPC again won two projects to supply the school furnitures requirements of DepEd- Region 10 and DepED-Lanao del Norte for a combined amount of about P 6, 000, 000. 0. The work was divided by the seven furniture members of the cooperative (a new furniture maker was added). In 2009, the IIMMPC was able to win three projects – to supply the school furnitures requirements of DepEd- Region 10, DepEd-Lanao del Norte , and DepEd-Region 7 (Negros, Cebu, Bohol) for a combined amount of about P 9, 000, 000. 00. The work was divided by the eight furniture members of the cooperative with a new furniture maker based in Cebu City was added to help supply the Region 7 project.

This study will deal with the use of the quantitative tools of PERT-CPM and Transportation Problem Technique in providing assistance in solving the

existing and potential problem of IIMMPC regarding production planning and scheduling and delivery cost minimization. STATEMENT OF THE PROBLEM With the increasing volume of works and the increasing vista of opportunity, the IIMMPC particularly the furniture maker/members are faced with various production and delivery problems. All DepEd projects are penalty project. Suppliers will be fined 1% of the amount of the items undelivered per day of delay in delivery.

Furthermore, the DepEd is very particular with quality. Inspection has to be requested before the items are delivered. One of the major cost elements of IIMMPC is the delivery or transportation cost. In anticipation to the possibility of getting projects in the R -13 (Caraga Region), in R-11 (Davao), R-12 (Cotabato), R-9(Dipolog and Pagadian, Zamboanga), in addition to the regular project in R-10(Misamis Oriental, Misamis Occidental, Bukidnon, and Lanao del Norte), the Cooperative is planning to set up other production centers on other parts of Mindanao possibly in Cagayan de OroCity and Butuan City.

This study will aim to answer the following problems: 1. What quantitative tool can be used by IIMPC in planning and controlling production to be able to deliver on time (and prevent being penalized and possibly be blacklisted) 2. How can the IIMMPC use this production planning and control method. 3. What quantitative tool can be used by IIMMPC in minimizing delivery expenses if ever the coop will set up other production centers in other areas in Mindanao. 4. How can the IIMMPC use this quantitative method in minimizing delivery cost. SIGNIFICANCE OF THE STUDY

This study will demonstrate to the IIMPC the importance of the use of quantitative tools in planning, controlling and monitoring their production and delivery system. To the businessman cooperators, using this tool could help minimize their cost of production, delivery, and other cost thereby improving their profitability. Using the appropriate quantitative method can help the cooperative improve their delivery performance thereby saving penalty fines and prevent being blacklisted by the DepEd. The IIMPC can be helped by these quantitative methods in identifying the other production centers that will provide the lowest delivery cost.

CHAPTER II REVIEW ON RELATED LITERATURE The need for armchairs in the Philippines has ballooned together with the increase in the population of students in the elementary and secondary levels. The Department of Education reported that the country is still 27, 124 classrooms short (New York Times, August 2009). It is imperative that these armchairs be supplied in the least amount of time in order for students to be able to learn in classrooms conducive to learning. Project biddings initiated by DepEd and won by furniture cooperatives in strategic regions in the Philippines could now supply the demand needed.

PERT/CPM, though usually utilized in large scale projects, may be used as a tool in order to finish the job. Program Evaluation and Review Technique (PERT) and the Critical Path Method (CPM) have been extensively used in a great number of projects that have too many processes that the manager cannot possibly remember all the information pertaining to the plan, schedule, and progress of the project. This method enables project makers

to do a project within the allotted time so as to avoid penalty arising from delay.

PERT was developed in the 1950s by DuPont for chemical plants. The emphasis then was on the trade-off between the cost of the project and its overall completion time. PERT was developed by the US Navy for the planning and control of the Polaris Missile Program and the emphasis was on completing the program in the shortest possible time (Corvinno PERT Presentation). In addition, PERT had the ability to cope with uncertain activity completion times A Transportation Problem Method is needed in order to determine which supplier is going to deliver to a particular school.

The transportation method was first formulated as a special procedure for finding the minimum cost program for distributing homogeneous units of a product from several points of supply to a number of points of demand. The earliest formulation of this basic transportation problem was stated by F. L. Hitchcock in 1941 and later expanded by T. C. Koopmans (Quantitative Approaches to Management, 8th Ed). The Vogel Approximation Method for transportation problems has been more utilized than other methods because more often than not, it gives an initial solution that is already optimum. Schools can now be supplied with their armchair needs.

With the help of the Department of Education and various furniture-making stores, more children can better build their dreams. CHAPTER III METHODOLOGY The necessary data were gathered through an interview with Engr. Ciriaco A. Darunday, Jr. , the proprietor of Crown Furniture. Figures given (e. g. activity time, transportation cost, etc.) were based on the

historical data from the conduct of the business. This study will deal with the use of two quantitative tools of providing assistance in solving the existing and potential problem of IIMMPC regarding production planning and scheduling and delivery cost minimization.

These methods are: I. Project Evaluation and Review Technique-Critical Path Method (PERT-CPM) II. Transportation Problem Technique PERT-CPM In applying PERT-CPM, one of the member of IIMMPC , CROWN Furniture will serve as the study model. It will be used in analyzing the production plan for the project assigned to the entity. Normal activity times are based on budgeted schedule on a regular operation. However, it has been found out that it exceeded the period in which the finished products are to be delivered, as agreed in the contract. Thus, crashing is required.

TRANSPORTATION PROBLEM TECHNIQUE In applying Transportation Problem Technique , a hypothetical model will be used whereby IIMMPC will be establishing production centers in Butuan City and Cagayan de Oro City in addition to that of Iligan City to serve the other regions in Mindanao. In this model, the best supply center to serve specific region in Mindanao can be determined . The result of this study can then be used to determine the appropriate production centers that should be set up to serve specific areas in Mindanao. Two alternatives used for the initial solution are: . Northwest Corner Rule 2. Vogel's Approximation Method Furthermore, improved indices were used to evaluate the initial solution. CHAPTER IV RESULTS AND DISCUSSION This section deals with the presentation of the two main important phase of the project undertaken by the IIMMPC. First is the presentation of the activities to be done by each manufacturing businesses

in completing the project. In doing this, we focused our study on Crown Furniture. Below is the list of activities taken up by the entity. Table 1. 1 LIST OF ACTIVITIES FOR THE CROWN FURNITURE ACTIVITY | DESCRIPTION | PREDECESSOR ACTIVITY | ACTIVITY TIME | | Start | Receipt of Purchase Order (PO) from DepEd |-- | | | A | Receipt of work assignment from IIMMPC with drawings |-- | 3 | | B | Draw list of material requirements | A | 3 | | C | Preparation of sample armchairs | A | 4 | | D | Inspection of samples by IIMMPC | C | 2 | | E | Purchase of lumber | B | 4 | | F | Parts preparation | D, E | 15 | | G | Purchase of hardware | B | 7 | | H | Assembly of subparts | F, G | 16 | | I | Assembly f complete unit | H | 22 | | J | Purchase of fininshing materials | B | 5 | | K | Fininshing (Varnishing and marking) | J, I | 20 | | L | Inspection of DepEd | K | 5 | | M | Delivery of the finish product to different schools | L | 5 | Thirteen activities are described and denoted A through M for later reference.

For a given activity, the predecessor activity column identifies the activities that must be completed immediately prior to the start of that activity. The last column shows the number of days required to complete each activity. Using these information a graphical representation of the project can be constructed. As computed, the slack associated with each activity can be determined. Slack is the length of time an activity can be delayed without increasing the project completion time. The amount of slack for an activity is shown as follows: TABLE 1. 2: ACTIVITY SCHEDULE FOR CROWN FURNITURE | ACTIVITY | ES | LS | SLACK | Critical Path? | A | 0 | 0 | 0 | Yes | | B | 3 | 3 | 0 | Yes | | C | 4 | 3 | 1 | No | | D | 8 | 7 | 1 | No | | E | 6 | 6 | 0 | Yes | | F | 10 | 10 | 0 | Yes | | G | 18 | 6 | 12 | No | | H | 25 | 25 | 0 | Yes | | I | 41 | 41 | 0 | Yes | | J |

58 | 6 | 52 | No | | K | 63 | 63 | 0 | Yes | | L | 83 | 83 | 0 | Yes | | M | 88 | 88 | 0 | Yes | Appendix A shows the network diagram for the project. The estimated completion time was determined to be 93 days. As stated in the contract, the duration of the project is 90 days. In addition a penalty will be imposed for any delay. As computed, the penalty amounts P 15, 600.

In order to meet the time constraint imposed by their client, the group used some quantitative techniques to analyze and evaluate the activities of the entity. Among various QM techniques, the Program Evaluation and Review Technique (PERT) and the Critical Path Method (CPM) seemed to be the appropriate model in this situation. Activities A-B-E-F-H-I-K-L-M have zero slack. Hence these activities are the critical activities for the project. This also determines the activities that can be crashed. In order to shorten the time needed to finish the project, additional resources are needed. The following table shows the cost associated with crashing an activity. TABLE 1. : NORMAL AND CRASH ACTIVITY DATA FOR THE CROWN FURNITURE | ACTIVITY | ACTIVITY TIME (DAYS) | COST (LABOR) | Mi | Ci' - Ci | Ki | | | NORMAL | CRASH | NORMAL | CRASH | | | Iligan City | Ozamis and Iligan | 3, 000 | | | | | Cagayan de Oro and Malaybalay | 1, 000 | | | | Cagayan de Oro | Cagayan de Oro and Malaybalay | 2, 000 | | | | Butuan City | Cotabato and Davao | 2, 000 | | | | | Gingoog, Butuan, Surigao and Tandag | 2, 000 | | | | | | | | | Iligan City | Ozamis and Iligan | 3, 000 | | | | | Cagayan de Oro and Malaybalay | 1, 000 | | | | Cagayan de Oro | Cotabato and Davao | 2, 000 | | | | Butuan City | Cagayan de Oro and Malaybalay | 2, 000 | | | | | Gingoog, Butuan, Surigao and Tandag | 2, 000 | | | | | | | | | | | | | | | | | | 88 - 62 + 50 - 76 | |= | 0 | | | | A4: | A4 - C4 + C3 - B3 + B2 - A2 | | | | | | | 110 - 25 + 122 - 62 +

50 - 76 |= | 119 | | | | B1: | B1 - A1 + A2 - B2 | | | | | | | | 55 - 28 + 76 - 50 | |= | 53 | | | | B4: | B4 - C4 + C3 - B3 | | | | | | | | 85 - 25 + 122 - 62 | |= | 120 | | | | C1: | C1 - A1 + A2 - B2 + B3 - C3 | | | | | | | 115 - 28 + 76 - 50 + 62 - 127 |= | 53 | | | | C2: | C2 - B2 + B3 - C3 | | | | | | | | 110 - 50 + 62 - 122 | |= | 0 | | | | | | | | | | | | APPENDIX E Alternative Optimal Solution | | | | | | | | | | | | | | | | 1 | 2 | 3 | 4 | TOTAL | | COST | | | | | | | | | | | | | | | | | | | | | | 28 | | 76 | | 88 | | 110 | | | | | | A | | | | | | | | | | 4, 000 | | 160, 000 | | | | | | | | | | | | | | | | | | | | | | | | | 55 | | 50 | | 62 | | 85 | | | | | | B | | | | | | | | | | 2, 000 | | 124, 000 | | | | | | | | | | | | | | | | | | | | | | | | | 115 | | 110 | | 122 | | 25 | | | | | | C | | | | | | | | | | | 4, 000 | | 270, 000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | TOTAL | 3, 000 | 3, 000 | 2, 000 | 2, 000 | 10, 000 | | 554, 000 | | | | | | | | | | | | | | | | | | | | | APPENDIX F Vogel’s Approximation Model | | | | | | | | | | | | | | | | | | | 1 | 2 | 3 | 4 | TOTAL | | COST | | | | | | | | | | | | | | | | | | | | | | | 28 | | 76 | | 88 | | 110 | | | | | | A | | | | | | | | | | 4, 000 | | 160, 000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 55 | | 50 | | 62 | | 85 | | | | | | B | | | | | | | | | | | | 2, 000 | | 100, 000 | | | | | | | | | | | | | | | | | | | | | | | | | 115 | | 110 | | 122 | | 25 | | | | | | C | | | | | | | | | | | | 4, 000 | | 294, 000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | TOTAL | 3, 000 | 3, 000 | 2, 000 | 2, 000 | 10, 000 | | 554, 000 | | | | | | | | | | | | | | | | | | |